Promoting Seismic Safety

Guidance for Advocates

by

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This work was conducted by the Mid-America Earthquake Center, the Multidisciplinary Center for Earthquake Engineering Research and the Pacific Earthquake Engineering Research Center as part of a Tri-Center project on Guidance for Earthquake Loss Reduction Advocates

May 2004

FEMA

Sponsored by the Federal Emergency Management Agency as part of the National Earthquake Hazards Reduction Program

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May 2004

MCEER-04-SP02

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Preface

This project represents a collaboration among social science and policy researchers at the three Earthquake Engineering Research Centers:

Mid-America Earthquake Center (MAE)
Multidisciplinary Center for Earthquake Engineering Research (MCEER)
Pacific Earthquake Engineering Research Center (PEER)

FEMA asked researchers at the three centers to distill the findings of previous social science and policy research in order to provide guidance to seismic safety advocates. Our hope is that the lessons of prior research will help advocates be more effective at promoting seismic safety actions.

To reach potential advocates, FEMA will provide these materials to partner organizations. Such organizations can then adapt the materials and deliver the content in a relevant format to appropriate members. This is not intended to be a static document for one-time publication and distribution by FEMA.

This publication consists of two parts: the guidance document for advocates, and background papers developed by the authors as part of the project.

GUIDANCE FOR ADVOCATES. This is a collection of concise tips for advocates, organized into the following topics:

Successful seismic safety advocacy
Earthquake basics
The ABCs of seismic building codes
Policies and legislation
Appearing before committees
Informing and persuading
Partnerships for seismic safety
Working with experts
Effective risk communication
Using the media

BACKGROUND PAPERS. Six papers were developed by the project authors to support and amplify the advice to advocates in the guidance document.

Partnership Plan (Peter May). In order to reach an audience of potential seismic safety advocates, FEMA needs to work with partner organizations to deliver the information in ways appropriate to their members. This paper describes a plan for accomplishing such partnerships.

Examples of Successful Seismic Safety Advocacy (Robert Olshansky). This paper describes—and draws lessons from—advocacy successes in Arkansas, California, Missouri, New York, Oregon, Utah, and Washington. It includes personal stories of the advocates involved in these successful actions.

Formulating and Evaluating Policy Alternatives (Daniel Alesch and William Petak). Drawing on two detailed cases—abatement of unreinforced masonry buildings in Los Angeles and Long Beach, California, and the 1994 amendment to the California Hospital Facilities Seismic Safety Act (SB 1953)—this paper presents a number of lessons on making and implementing policies. It concludes with strategies for devising effective policies and programs.

Gaining Attention (Daniel Alesch and William Petak). Summarizing relevant public policy literature, this paper explores ways to identify appropriate decision makers relevant to the problem. It provides advice on gaining the attention of persons, organizations, and institutions that can make a difference in reducing the risks to life and property from earthquakes.

Communicating Risk (Kathleen Tierney). This paper provides guidance that will enable advocates to craft effective risk communication messages and campaigns, deal with issues that are unique to earthquake risk communication, and avoid mistakes in communicating clearly about the need for seismic safety.

Mobilizing Support (Kathleen Tierney). Picking up where the previous paper left off, this one gives advocates a better understanding of how to motivate action in support of loss reduction efforts. Presented here are concepts and strategies needed to persuade others to engage in mitigation activities.

The five authors developed the materials through a series of meetings from February 2002 through February 2003. We also acknowledge the active participation of our FEMA project sponsor, Elizabeth Lemersal. Sarah Nathe edited the final version of the guidance document. We thank the following seismic safety advocates who joined us at some of our meetings and/or provided helpful comments along the way: Mark Benthien, Marjorie Greene, Lind Gee, Bill Holmes, Sarah Nathe, Tom O'Rourke, Chris Poland, Richard Roths, Susan Tubbesing, and Maria Vorel.

Finally, we acknowledge the support of the Earthquake Engineering Research Centers Program of the National Science Foundation, which primarily sponsors the three Earthquake Centers, MAE, MCEER and PEER.

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Introduction

Promoting seismic safety can be challenging because people seem indifferent to its benefits or decision makers dismiss good ideas about ways to make buildings and communities more resistant to the damaging effects of earthquakes. Advocates work hard and care deeply, yet often feel that their efforts are ignored. Given these frustrations, advocates sometimes give up, or wait for another day. This resource kit is meant to inspire all advocates to keep working toward their goal. The briefs assembled here distill what we have learned—through research and experience over the last 40 years about promoting seismic safety in the United States.

We have used a very broad definition of “advocate.” Advocates can be almost anyone: people whose jobs involve public safety; design professionals who want to make a difference; those who work in organizations with missions to increase seismic safety; and citizen-activists who have a personal stake in earthquake safety. Many potential advocates do not think of themselves as such because they are not trying to change seismic safety policy. But seismic safety can be increased at levels as various as design and building professional practice, planning commission and special district procedures, and implementation of public safety programs. People who try to increase the adoption and enforcement of seismic building codes or assess the earthquake safety of schools are in fact seismic safety advocates.

Across the United States, advocates have improved seismic safety in areas with moderate to very high degrees of seismic risk by arguing for reduction of future losses in damaging earthquakes, and by calling attention to the economic and social vulnerability of their community to the losses an earthquake could inflict. Especially important to consider are buildings that are built to out-of-date and inferior codes, where people nonetheless live and work.

Successful advocates point out another rationale for seismic safety—more earthquake resilience in highways, power and utility systems, buildings, and communities means increased resilience to other types of damaging events, both natural and human-caused. Talking about seismic issues often has the benefit of raising questions about the condition of facilities or the readiness to respond to any extreme event.

The premise underlying the following suggestions is that seismic safety advocates come in many forms and with many levels of knowledge and experience. Each of the following briefs may be more relevant for some advocates than for others. The first three briefs present concepts to know before starting to talk about seismic safety. The second three discuss groups to target in working to improve seismic safety. And the final four briefs describe tools available to seismic safety advocates.

- Successful Seismic Safety Advocacy
- Earthquake Basics
- The ABCs of Seismic Building Codes
- Policies and Legislation
- Appearing Before Committees
- Informing and Persuading
- Partnerships for Seismic Safety
- Working with Experts
- Effective Risk Communication
- Using the Media

What is Seismic Safety?

Earthquakes damage structures—buildings, roads and bridges, utility and communications systems—and those damaged structures kill and injure people and cost a great deal to fix. And while the structures are not functioning, the businesses that rely on them either fail or face great financial hardship. Seismic safety advocates attempt to reduce all earthquake losses in various ways. Structures can be strengthened to resist shaking, either when they are built or later in their lives, or they can be sited in areas less subject to violent shaking. But increasing seismic safety requires knowledge of the earthquake hazard in a community or area, an understanding of how to reduce structural damages, and a willingness to spend the money and time necessary to do so. Decisions to invest in seismic safety are made by individuals, private and public sector organizations, and by governments, so the goal of seismic safety is served by risk education, community activism, and political activism.

The Seismic Safety Hit Parade

Seismic safety projects are as various as the communities at risk to earthquake damage, but some projects are common to all areas in the United States because they are critical steps in improving understanding of earthquake risk and inspiring a commitment to loss reduction. You can't undertake all of these at once, and may not need to invest the same level of energy in each one, but sooner or later your journey to increased seismic safety will require you to develop projects in each of the ten areas below.

1. Improved understanding of earthquakes—learn about quakes from local, regional, state or federal earth scientists.
2. Comprehensive analysis of local risk—learn about how quakes damage the built environment from local engineers, emergency managers, academics, state and federal government experts, and risk analysis firms.
3. Wide familiarity with the many ways to reduce risk—structural engineers, geotechnical engineers, academic researchers, engineering associations, and governmental agencies can explain and recommend the best earthquake-resistant design and construction techniques
4. Clarified costs and benefits of reducing risk—who pays, and who benefits—before the quake and after it.
5. Broad communication of elements in items 1-4, above, to the community.
6. Campaigns to persuade specific audiences that something can and should be done.
7. Wide cooperation among individuals and groups to decide which losses are most important to reduce and how best to do so.
8. Proposal of new practices, procedures, or policies to various groups.
9. Strategies for achieving official adoption by governments and organizations of new policies and procedures that reduce risk.
10. After adoption, it is still necessary to promote, monitor, and enforce actual implementation of policies and procedures because real people in actual situations may not understand why it is important to comply.

Successful Seismic Safety Advocacy

Though seismic safety advocates are a diverse group, there is much similarity in the steps they take to succeed in their work. Aspiring advocates can distill a few basic lessons from their tried and true strategies. The most important lesson is that individuals can make a difference. The second is that collectives can leverage the power of individuals. Four additional golden rules complement the first two.

Be Persistent, Yet Patient

Persistence. It takes time to introduce the importance of seismic safety to the public and to decision makers. Repeated efforts are necessary to make the case that earthquakes are a threat and that cost-effective actions can be taken to reduce the threat. Those interested in ensuring that their community takes steps *before* an earthquake must convince skeptics that a serious problem exists, that something can be done about it, and that the solution is affordable. All this requires persistence.

Patience. Try to take the long view, and remember that earthquakes are a long-term issue. All successful seismic safety initiatives have had their ups and downs in the process of public debate. Each step, no matter how small, brings you closer to the goal, even if it takes a while to get there. Be incremental.

Have a Clear Message

Identify the problem and its solution. In plain language tell your audience what the problem is and how your initiative will solve it. If they do not understand the problem, they will take no interest in the solution.

Propose specific solutions. Propose actions that your audience can endorse and accomplish. Specific solutions are more likely to be adopted and carried out. If the solution is clear, detailed, and specific, decision makers can readily adopt it when the opportunity arises.

Have a message that is clear and consistent. The message must be easily comprehended and remembered. If it is too complicated, your audience will neither remember it nor act on it.

Repeat the message. Find multiple opportunities to present your message to both the narrow and broader audiences you seek to influence—in print, in public presentations, at public meetings, and to the media. Each time you repeat the message, more people will remember it. It is especially effective to present the message after significant earthquakes in your own region or even in other parts of the world because then people are more aware of the actual damages earthquakes can inflict.

Understand the Big Picture

Appreciate the audience's point of view. For most people, earthquakes are not an important concern. Understand your audience's current knowledge and perception of the risk. Explain the importance of seismic safety in a way that is meaningful to them. Remember that citizens and elected officials must be convinced that reasonable steps can be taken to protect against the earthquake threat at reasonable cost—or they will not act.

Identify a good audience for your effort. Rather than trying to reach all the people all the time, focus your energy on a small set of people inside or outside of government who can understand the earthquake risk and commit themselves to action. They will then influence larger groups to reduce future losses.

Link seismic safety to other issues. Point out how seismic safety also addresses other community issues, such as the safety of schoolchildren, protection against other hazards, fiscal health of the local government, and long-term sustainability of the local economy. In particular, show how seismic safety can preserve businesses and public sector organizations, and thereby stabilize the task base or ensure the continuity of government and educational institutions. Those are important day-to-day public issues. Similarly, proposals for enhanced earthquake safety will be more acceptable if they are part of a multi-hazard protection package. It is possible to design and implement precautions that protect against many perils: high winds, storms and storm surges, willful acts of destruction, and industrial accidents.

Identify potential opponents. Various groups will come forward with arguments against seismic safety actions. Identify these opponents early on, meet with them, and try to understand their perspective. At least, be familiar with their arguments. Chances for success will increase if you can involve them, develop consensus solutions, and gain their support.

The media are your friends, but use them wisely. The media have the power to communicate your message widely. They can also gain the attention of decision makers. Before approaching the media, be sure that you have a clear message as well as broad support from local seismic safety professionals.

Work with Others

Create partnerships and build coalitions. Identify potential allies and partners who can gain from promoting seismic safety. The support of other organizations and individuals can be the critical difference between success and failure. Start with your own networks, and then reach out to other relevant professionals and community organizations. Be sure that partners gain appropriate recognition and praise.

Personal contacts are vital. Develop friendly, trusting relationships among the people you must work with, including your allies, potential opponents, and decision makers. Make yourself known as reasonable, credible and responsible. Know whom to call, and when to call them. Organizations are important, but they consist of individuals who make decisions about whether or not to take action.

Make seismic safety efforts permanent. Try to develop organizations, procedures, statutes, or regulations that institutionalize seismic safety. These can range from state seismic safety advisory committees, to city building code commissions or professional organizations. Seismic safety advisory committees are particularly valuable, because they can extend your efforts, maintain public awareness of seismic safety, increase credibility of the message, develop and promote solutions, and build on previous successes. Formal groups frequently bring with them some financial resources, and even modest funding for a new organization or process can provide powerful leverage.

Who is a Decision Maker?

Anyone who decides to do something that will reduce future earthquake losses is a decision maker of interest to you. There are decision makers in governments—local, county, state, and federal. They may be elected officials or career civil servants. In private companies—small and large—decisions are made by owners, executives, or boards of directors. In public organizations such as schools and community service agencies, there may be decision makers at many levels. In schools, for example, seismic safety decisions can be made by teachers, PTA members, principals, and superintendents. It may not be evident in every case who the critical decision maker is, so you may have to higher, lower, or sideways in order to find the person who will help you. Leaders of families make decisions for or against seismic safety, as do single people living alone.

Who Is the Public?

There is no such thing as "the public." There are many publics within a community—individuals, small groups and large institutions, each with self-identity and self-interest. Depending on the outcome you're working for, various audiences must be educated and persuaded. The media can help you reach many groups and individuals, but at the same time, the media are themselves a group in need of education. At community meetings you will meet other audiences. Just as the public is not one thing, it is not static. The groups and individuals who can support your project will change over time, but a successful advocate will change also to ensure that the seismic safety project and goals remain viable.

Earthquake Basics

There are characteristics of earthquakes and their risks that you must be clear about yourself before you start talking about them to others. Over the years, earth scientists, engineers, and others who spend much of their time studying earthquakes have developed a set of terms relating to earthquakes that have very precise meanings, but which are often confusing or meaningless to those outside the field. This brief highlights some of the key concepts that commonly arise in discussions about seismic safety.

Every Earthquake is Unique
Each earthquake is a unique combination of characteristics: location, magnitude, depth, type of fault, mechanism of fault rupture, and direction of rupture. In addition, the soils in the area determine how fast seismic waves move, how quickly their energy dissipates, and whether or not they focus on particular sites. Thus, although we like to draw lessons by comparing one earthquake to another, these comparisons can only go so far.

Magnitude is the Usual Measure of an Earthquake
The magnitude of an earthquake describes the absolute size of the event. It is a measure of the energy released by the earthquake. Generally, higher magnitude earthquakes have greater shaking intensities at the epicenter, shake for a longer time, and affect a larger area. Several magnitude scales are currently in use, and they are all different, especially for larger earthquakes. The well-known Richter scale is one magnitude scale, but seismologists have increasingly begun to favor the *moment magnitude scale* because it gives more reliable results for larger earthquakes and those more distant from recording devices.

Intensity is Another Way to Describe an Earthquake's Size
Earthquake intensity scales qualitatively describe the effects of ground shaking rather than the energy released. While an earthquake is described by a single magnitude, it will produce a range of shaking intensities across an area. Because the intensities describe what the shaking feels like and how it affects different types of structures, they are terms that most people understand. In the United States we use a scale that ranges from Intensity I ("Not felt except by a very few under especially favorable conditions") to Intensity XII ("Damage total"). Intensity is usually greatest near the earthquake epicenter, and less away from the epicenter, but it can increase in certain areas of poor soil.

Earthquakes of Similar Magnitudes May Have Different Effects
Two earthquakes of magnitude 6.5 can cause dramatically different levels of ground shaking because they may differ in depth or mechanism of fault rupture. The 2001 magnitude 6.8 Nisqually earthquake, for example, shook a wide area near Seattle but caused much less damage than the 1994 magnitude 6.7 Northridge earthquake in Los Angeles because the Nisqually earthquake was extremely deep and did not cause severe shaking at the earth's surface. Earthquakes of similar magnitude can also cause differing levels of damage according to their proximity to populated areas. The 1995 magnitude 6.9 earthquake in Kobe, Japan, was much more devastating than the Northridge quake

because the strongest shaking was in the most densely populated areas of Kobe, whereas the strongest shaking in the Northridge quake was under the mountains north of Los Angeles.

Smaller Earthquakes Can Cause Damage and Injuries
Earthquake damage at any given point depends on magnitude, distance to the rupture, the local soil conditions, and the building types, so even smaller magnitude earthquakes (between 5 and 6) can cause considerable damage and injuries in particular localities.

Softer Soils are usually Less Safe than Firm Ground
Generally speaking, softer soils shake more than firmer soils. Sandy and water-saturated soils can also experience *liquefaction*, in which the ground turns to mush during the shaking and loses its ability to support structures.

It's not only about the Fault Line
Everyone in a seismically active region should be concerned, not just those located "on the fault line." Because earthquake waves radiate out from faults and cause damages over large areas, seismic safety precautions are important region-wide. It is more important to worry about overall seismicity of an area than to know only the location of faults. The most current U.S. Geological Survey seismic hazard maps of the U.S. are at http://geohazards.cr.usgs.gov/eq/.

Unknown Faults often Cause Earthquakes
Earthquakes can strike on faults that were previously unrecognized. Many such earthquakes, for example the 1994 Northridge quake, have been extremely damaging. Because, by definition, earthquakes on unknown faults can't be anticipated, it is more prudent to focus on an area's overall seismicity in determining its earthquake risks.

Seismologists can Estimate Long-term Earthquake Probabilities
Based on historic earthquakes and evidence of prehistoric earthquakes, seismologists are able to estimate the long-term probabilities of earthquakes in seismically active areas. These estimates, however, are only approximate, because we do not have enough years of records to make statistically reliable estimates. The estimates are useful as a basis for seismic building codes, as well as for comparing hazard between regions, and do give some indication of the likelihood of future damaging earthquakes.

We know where large earthquakes have occurred in the United States in the past few hundred years. We know that similarly large earthquakes will occur again, and in some places more probably than in others. We do not know precisely where or when they will happen or how strong they will be. When speaking with a lay audience, it is generally better to avoid technical terms like "expected return period," and to say something like, "From historical evidence, we expect an earthquake on this fault about every 180 years, and it has been 179 years since the last one." Earth scientists also say, "An earthquake of this magnitude in this area has about a 50% chance of happening sometime in the next 30 years."

Short-term Earthquake Prediction is not Possible
Seismologists are not able to predict imminent earthquakes, as a weather forecaster can predict a hurricane. Due to the physical characteristics of fault rupture, such predictions may never be possible. Because earthquakes occur without warning, increased seismic safety is vital.

An Earthquake can Occur at Any Time
If seismologists say that a damaging earthquake has a 50% chance of occurring in your region during the next 30 years, that can be translated to mean that it has approximately a 2% chance of occurring in any given year. The probability is the same this year as it will be next year or two years from now. People often speak of earthquakes occurring sometime in the future, but the truth is that they can happen *right now*. Because earthquakes occur without warning, communities must be prepared in advance. There are many options for a community. They can take steps to reduce the number of unsafe old buildings or move people out of them. They can adopt codes that ensure new buildings will be earthquake-resistant. They can strengthen vulnerable buildings. They can modernize their infrastructure and make it more damage-resistant. Or they can reduce the financial consequences of damages through insurance.

What is Infrastructure?

A community is served by many networks—utilities, transportation routes and systems, and communications systems—that support the daily flow of life and commerce. These infrastructure elements are frequently damaged in earthquakes and, when they are, can threaten lives and property, and seriously disrupt the routines of community life. Fires can result from electrical downed electrical wires or ruptured gas mains. Interruptions to water, sewer, electrical power or gas service will affect the lives of everyone, very negatively over time. Interruptions to communications will quickly have large personal and business impacts. Broken transportation links make it difficult or impossible for life or commerce to flow anywhere. Damage to one or two infrastructure elements poses a problem that most communities can work around, but damage to all or most of the elements is a disaster that will grind everything to a halt. Protecting infrastructure against earthquake damage is very important and can be accomplished either through retrofit or replacement.

The ABCs of Seismic Building Codes

Seismic building codes are one of the most obvious ways to increase building integrity and ensure the future safety of communities. Codes are not a panacea for all problems, so it's helpful to know how they work and what they can do. Incorporating new or additional seismic safety provisions in codes for new buildings has been easier than designing, enacting, and implementing requirements for retrofitting existing buildings, but even if all new buildings are built well, older buildings remain hazardous. Where huge stocks of old buildings are very vulnerable to earthquakes, as in the East and Midwest, net improvements in seismic safety will be marginal if seismic elements in codes apply only to new buildings.

What Seismic Building Codes Can Do

Seismic building codes result in earthquake-*resistant* buildings, but not earthquake-*proof* buildings. Seismic codes are intended to protect people inside buildings by preventing collapse and allowing for safe evacuation. Structures built according to code should resist minor earthquakes undamaged, resist moderate earthquakes without significant structural damage, and resist severe earthquakes without collapse. Codes only recently began to address mitigation of nonstructural, or content, hazards in buildings, which can cause casualties and expensive damage.

Building Collapse is not the Only Problem

Even if a building does not collapse in an earthquake, it can still seriously hurt or kill people. Buildings are full of nonstructural components—light fixtures, heating ducts, windows and suspended ceilings—that can fall on people or block escape routes. Finally, plaster, falling bricks, parapets, window glass, or the facades of buildings can seriously injure people walking by or exiting.

Even Code-Compliant Buildings can be Damaged

The contents and interiors of code-compliant buildings may be extensively damaged in an earthquake and the building may not be functional until repairs and clean-up are completed. Therefore, damages to code-compliant buildings can be costly. Comprehensive safety and loss reduction programs include properly designing and bracing nonstructural elements.

Newer Buildings are generally Safer than Older Buildings

Because they are built under more advanced codes, newer buildings are usually (but not always) safer than older buildings. Steel-frame high-rises and newer wood-frame low-rises are usually (but not always) the safest structure types. Exceptions to those generalizations are due to variables such as the configuration of the building, the quality of the construction, the design of the joints, and the manner in which seismic waves strike a particular site.

Older Buildings are frequently not Seismically Safe

Generally speaking, seismic codes did not come into wide use in the eastern U.S. until the early or mid 1990s. In the western U.S., seismic codes made substantial improvements in construction as early as the mid 1970s. Buildings constructed prior to these respective dates in each area are probably not seismically safe. Retrofitting buildings to achieve seismic resistance is possible, but often costly, so choices must be made about which buildings are most important to fix. It makes economic sense to target the most dangerous structures or the most dangerous features of those structures, such as flimsy parapets.

Seismic Codes Vary across the United States
The seismic provisions of building codes are based on earthquake hazard maps that show the probabilities of certain levels of earthquake shaking in particular areas. The code requirements reflect the fact that some places are more likely than others to have strong earthquakes. The entire country is not required to meet the same seismic design standards as the state with the greatest risk: California. Places that have less severe and less frequent earthquakes have less stringent design requirements. For example, seismic codes require less in Boston than in Los Angeles. Conversely, seismic code requirements in southern Illinois, near the New Madrid seismic zone, are much stricter than in Chicago, which is less likely to have a strong earthquake.

Adherence to Seismic Codes is not as Expensive as Many Think
Complying with a seismic code adds relatively little to the costs of a structure. The most recent study estimates that it adds less than 1% to the purchase price of a home, and from 1%-2% to the total cost of new commercial and industrial buildings. (See ***Promoting the Adoption and Enforcement of Building Codes,*** in the **Further Reading** section.)

Some Structures are more Important than Others
Buildings with high occupancy, critical response services (fire, police, hospitals), and vulnerable populations (schools, nursing homes) should be built to code, or above it. It is also important to protect utilities and infrastructure. Damages to critical structures lead to more life loss, larger economic loss and greater social disruption, and slow community response to earthquakes.

Building Code Adoption is a State or Local Responsibility
All states have a legal right to regulate building safety as a matter of public welfare. In most states, the day-to-day aspects of this rest with local governments. Some states require local adoption and enforcement of building codes; others do not. Just because codes are required, it does not guarantee that all localities comply. And in states that do not require codes, localities are free to do as they wish. In fact, many earthquake-prone communities in the U.S. do not have up-to-date building codes with seismic provisions.

Codes Change over Time
The model building codes and the seismic provisions are revised every three years to incorporate new knowledge. In order to have a code that reflects the current state of the art in seismic design, state and local governments need to incorporate the latest seismic details into their codes.

Building Codes versus Seismic Provisions
Localities can adopt a model building code, but leave out the seismic requirements. Or they may have an older version of the code, written prior to inclusion of seismic provisions. It is important to verify that the locally adopted code contains the most recent seismic provisions.

A Building Code must be Enforced in order to be Effective
Building plan review, construction inspection, and a qualified and trained building department staff are necessary for code enforcement.

Model Building Codes

When a municipality decides to adopt or revise a building code, it generally chooses a model construction code and amends it in various ways into its codes and ordinances. In 1994, the International Code Council (ICC) was established to develop a single set of comprehensive and coordinated national model construction codes, among which is the International Building Code (IBC). The founders of the ICC are the Building Officials and Code Administrators International, Inc. (BOCA), the International Conference of Building Officials (ICBO), and the Southern Building Code Congress International, Inc. (SBCCI). These three organizations previously administered three different codes: the National Building Code (NBC), the Standard Building Code (SBC), and the Uniform Building Code (UBC). The presence of three model building codes had the disadvantage of allowing widely divergent code standards across the country. Recently, the National Fire Protection Association developed a national model code, the NFPA 5000. States and localities that currently write their own codes or amend the model codes have begun adopting the International Codes and the NFPA 5000. Both the IBC and NFPA 5000 contain up-to-date seismic provisions; adoption and enforcement of either of these codes will lead to higher quality construction and consistent code enforcement in earthquake-prone areas.

Policies and Legislation

In many cases, it will be most effective to make the primary case for earthquake safety to a few key decision makers in the public sector. Policy-making processes are complex, but not hopelessly so, and policy-makers are accessible, if you "know where they live." New policies and laws are proposed and enacted almost every day. Once enacted, policies must be implemented, and that is often more complicated than policy adoption. With foreknowledge of the ins and outs, however, you will have a much better chance of success.

Learn How "Things Work" in the Legislative or Executive Agency
High school civics classes teach that policy processes follow an ordered procession, involving, for example, 13 steps for a bill to become a law. In reality, public policy making is anything but linear and predictable. Although they share many rules and procedures in common, each legislative and executive policy-making body has unique characteristics. Typically, you can learn what the formal rules are directly from agency personnel, but it is more difficult to learn informal processes and hidden agendas. If your own elected representative shares an interest in seismic safety, he or she may be of great help.

Have Public Policy Proposals Ready When the Time is Ripe
Usually elected officials create policies to solve problems after a crisis has occurred. For example, a policy decision to raise the level of a causeway or a levee usually comes shortly *after* the flood. Most earthquake-related legislation is enacted in the immediate aftermath of a damaging earthquake—in what is called the "window of opportunity"— but not all of it is well conceived. The old adage is that we "legislate in haste and repent at leisure." Advocates seeking to influence policy should be prepared with proposals that are thought through and ready for consideration and adoption during the rush of concern that follows a damaging earthquake.

Gain Access to Policy Makers Who Will Champion Seismic Safety
Policy agendas are crowded and it is difficult to gain the attention of policy makers. The effective earthquake safety advocate must get access to policy makers and their staff to make the case for seismic safety policies. Access is easiest in the immediate aftermath of a damaging earthquake, especially if advocates have coherent and effective proposals in hand. This is because concern for earthquake safety is on everyone's mind then, demanding attention to possible solutions from policy makers.

Being a member of public or quasi-public organizations charged with helping to develop seismic and building safety policies provides continual, institutionalized access to policy makers. Several states have boards or commissions charged with making recommendations about seismic safety. Similarly, non-governmental groups draft building code updates for consideration and adoption by governments.

Get a Critical Mass of Policy Makers to Agree about the Problem
A problem is not a problem unless a critical mass of policy makers sees it and agrees that something can be done about it. Advocates may view the potential for major losses from earthquakes as a problem that demands immediate attention by public policy makers, but not everyone will agree. Policy makers must concur that there are potential unacceptable consequences from an earthquake within a relevant time frame, and that they are willing to do something to reduce the consequences.

Policy Making Is Largely Political and Economic, Not Technical
Enhancing seismic safety policy requires political and economic understanding as well as geologic and engineering knowledge. Having solutions that meet political, social, and economic criteria is as important as having solutions that are technically effective. Have on hand not only examples of what can be done, but also evidence of how those steps have been effective in other places, and information about how much each solution costs. You must convince the already overburdened that doing something provides benefits at costs that are generally tolerable.

Propose Workable Solutions
A workable solution must have an acceptable price tag, sufficient backing to overcome opposition from credible opponents, and evidence of having worked somewhere else. Legislators rarely invent solutions—they get them from experts, other advocates, and other jurisdictions that have addressed the issue. The savvy policy advocate works to gain support from others who have an interest in the problem or who might be affected by implementation of the proposed solution. Most elected officials do not like to have proponents and opponents of a particular policy proposal besieging them; they are happy when all the involved parties come to them with a policy proposal in hand and generally agree that it is the best way to move ahead.

Not All Policies are Regulatory
Policies may be designed to focus attention, as is the case with the official establishment of April as Earthquake Awareness Month in California or May as Tornado Awareness Month in Wisconsin. Policies may also force action, either directly or indirectly. For example, California has an Earthquake Hazards Mapping Program that directs the Geological Survey to map earthquake hazards all over California, and requires public and private parties to use the maps in assessing the potential hazards to any proposed development. If the risk is high in a certain location, the developers must incorporate appropriate mitigation into the project or they must relocate. Policies may call for public investment, provide for more effective system management, or authorize direct action by public agencies to reduce earthquake risks, for example, increased seismic safety in federally owned buildings was mandated by Presidential Executive Order 12941 in 1994.

Self-policing policies are more cost-effective than those that require extensive monitoring and control. Such policies provide strong incentives for individuals and organizations to engage in the desired behavior either by lowering the costs (monetary and non-monetary) of doing what is hoped for, or by raising the costs of engaging in undesired behaviors. The former case is exemplified by a number of city programs in California that waive many fees normally associated with residential construction and shorten the permit process in order to encourage home owners to strengthen their houses against earthquakes. Obvious instances of the latter case are the state governments that heavily tax tobacco products and use the generated funds to conduct public education campaigns about the dangers of smoking.

Policy Enactment Is Just the Beginning

Policies adopted by legislative or executive bodies are formal statements that put forth what the policy makers want the general rule to be. Policy is modified through the layers and sets of actors that deal with it, right down to the person in the field who does the work directed by the policy. As implementation proceeds, it may trigger new or additional opposition to the policy, with threats of modification or repeal.

To stand the test of time, policies must strike a balance among various parties interested in the problem being addressed. Frequently, policies that were devised and supported by seismic safety advocates are subsequently challenged by groups whose interests are adversely affected by those policies. In the case of ordinances requiring seismic strengthening of old buildings, the challenges are often effective, at least until the next earthquake. Advocates can be successful in getting what is needed if they are prudent and thoughtful about what they propose, particularly if they keep a few points in mind.

Design Policy to Meet the Legitimate Needs of Likely Opponents

The community of seismic safety proponents is small and, in most locations, without much political clout. There are usually many interests likely to oppose the costs associated with enhanced seismic safety. Look at the problem in the broad context to identify legitimate interests that will be positively and negatively affected by any proposal. The greater the burden perceived by the opposition, the more fiercely they will fight the advocate’s proposal.

Devise solutions to the problem that meet the fundamental, legitimate needs of those who would otherwise be opposed. This requires willingness to compromise and a creative, non-dogmatic approach to policy design. A policy enacted into law is more likely to remain in place over the long term if it is supported broadly by those it affects than if it was enacted over the opposition of groups with an important stake in the outcome.

Remember That Nothing Lasts Forever

A policy that was effective and appropriate at one time may become ineffective and inappropriate as conditions and circumstances change. Problems “morph” out from under solutions. The challenge for those interested in seismic safety is to adjust strategies and policies as circumstances change. The challenge is made more difficult by the nature of legislation; only rarely can it be written to provide sufficient flexibility to deal with both a wide range of initial circumstances and underlying shifts in the context.

National Seismic Safety Policy

The National Earthquake Hazards Reduction Program (NEHRP) was established in 1977, under the authority of the Earthquake Hazards Reduction Act of 1977, enacted as Public Law 101-614. The purpose of NEHRP is to reduce the risks of life and property from future earthquakes. The NEHRP research and mitigation activities are funded by four primary federal partners—FEMA, National Institute of Standards and Technology, the National Science Foundation, and the U.S. Geological Survey. NEHRP funds basic and applied research into earth science, building and infrastructure performance and design, and information dissemination by governmental and non-profit agencies working on many aspects of earthquakes and seismic safety. These Advocacy Briefs were developed with funds from NEHRP. Learn more about NEHRP at http://www.fema.gov/hazards/earthquakes/eqmit.shtm

Appearing Before Committees

At some point in his or her career, a seismic safety advocate may be invited to appear before legislative or advisory committees that have roles in shaping seismic safety policies. These bodies may include school boards, municipal councils, state legislatures, Congressional committees, advisory committees like city and county planning commissions, or code committees. The suggestions below will help make the experience comfortable and productive.

Do Your Homework about the Committee and the Purpose of the Meeting
Before scheduling meetings with committee staff or agreeing to testify, establish the relevance of the committee to the issues that you want to address. Be clear about the purpose of the hearing you will be attending and your testimony's fit with that purpose. It makes little sense to appear before a committee that is neither the correct forum for the topic nor concerned with the specific issues you are going to raise.

Be Clear about What You Are Advocating
In crafting suggestions to the committee, be clear about your facts, the problem, and the solutions you wish to advocate. Focus on two or three key points to get across. A sea of facts about a problem or heart-wrenching stories about harms do little to help a committee understand what you want them to do to address the problem.

Prepare a Simple and Direct Message
Committee members are not likely to be experts on seismic safety so your testimony should educate committee members in an informative manner. Detailed or technical points can be submitted in written testimony for the record or as background materials for interested staff and committee members. Only a short time is available for testimony, so fill it only with critical information.

Establish Your Credentials
Introduction to written and oral testimony should clearly establish who you are and, most importantly, whom you represent. Establish the type of expertise you have and the breadth and depth of the group that you represent. The logic for this is that elected officials, in particular, respond to groups rather than to individuals. It is important to mention that the group you represent endorses your comments.

Convey Credibility through Delivery
Present your information in a convincing manner. Use charts that display relevant information (as handouts or displays). List sources for your information. Acknowledge counter claims and point out why they are not accurate. Maintaining eye contact with committee members is an important way of subtly establishing credibility.

Anticipate the Environment for the Hearing
Many who testify are tripped up by not having the proper equipment available, not realizing that the committee is running behind (or ahead), not being able to adjust testimony to a shortened timeframe, being thrown off by other testimony, and not being prepared for any media that might be present. Anticipate potential hiccups by checking ahead on arrangements, knowing who else is involved and the format for the session, being prepared for all media personnel, and being ready to adjust the length of your testimony.

Practice Your Remarks and Responses to Questions
Practice to gain comfort with the material you are presenting. A rehearsal will allow you to assess how clearly you can communicate with your audience. It helps if the practice sessions are in front of some individuals familiar with the perspectives of the actual committee audience. An important part of such practice sessions is anticipating questions that may come up.

Be Prepared for Questions
Not all questions can be anticipated, but many can and should be. As with the testimony itself, responses to questions should be succinct, accurate, and credible. Resist the temptation to guess if you do not know the answer. It is better to respond that you will find out the answer and respond later in writing. Saying "I don't know" is acceptable as long as it is not the only response you can offer to each question.

Follow up
As committee procedures allow, edit your comments for the record to correct any mistakes in your own or others' testimony. Promptly send in written responses to questions you could not answer at the time. The written record of any testimony is often more important than the testimony itself. It has a longer shelf life and reaches many more people.

Work with Staff
Committee staff members are more than gatekeepers; they are also information conduits and repositories of knowledge for committees. It is as important as the testimony itself to help them by making written materials available in advance, providing timely follow up to questions, and responding to their concerns. A good relationship with the staff can result in repeated invitations to appear before committees.

Informing and Persuading

Some people think that the only way to improve seismic safety is to get a policy enacted or changed at the local, state, or federal level, but there are actually many other effective ways to do it, most of which are easier or quicker than new policies or amended legislation. There are various interventions that can improve seismic safety.

Provide Information about the Earthquake Risk
No individuals or organizations will take action to reduce risk unless they know it exists, they think it may affect them, and they know they can do something about it. Before proceeding to any of the steps outlined below, develop messages for key decision makers and those who influence them. Tailor all information to each audience's sophistication. To make the messages believable, have them delivered by people who are specialists and/or are thought of as credible by the target audience.

Influence Government Agency Practices and Procedures within Existing Policies
It is not necessary to change laws to influence what government does. Even without new laws, governments can choose to increase the seismic safety of the facilities within their purview and improve community services. Local public utilities rarely need to change ordinances to design and build more resistant structures. Community building departments can encourage and enforce seismic safety practices. Training can affect field practice within the letter and spirit of existing ordinances to focus more attention on seismic safety provisions. Building and planning departments, emergency management offices, and housing agencies can provide seismic safety information to their constituencies. Governments can choose to rent only facilities that incorporate seismic safety design elements. School boards can choose to reduce the nonstructural hazards in their classrooms. Universities can add natural hazards risk management to business and public administration curricula.

Influence Choices Made by Private Organizations
Ultimately, seismic safety is enhanced when structures are located, designed, and constructed appropriately. Sometimes, it makes sense to work directly with individuals and organizations that build and use the structures, rather than to try to change the legal or regulatory environment. Seismic safety can sometimes be sold to individual organizations if it is incorporated at tolerable costs when structures are being built or changed to realize other, unrelated benefits, such as increased organizational efficiency or more structural compatibility with new processes.

Direct communication by shareholders, managers, employees, or third parties may induce a corporation's leaders to promote seismic safety in their own operations and structures. Rate payers can influence utilities to better protect water, gas, electric power, and waste water systems against earthquakes. Organizations already committed to seismic safety can influence other businesses and not-for-profit organizations. Trade and business associations, such as Chambers of Commerce, can be reached through groups focused on earthquake risk reduction, such as the Building and Industry Council on Emergency Preparedness Planning in the Los Angeles area, or through organizations dedicated to bringing an earthquake safety message to the community.

Influence Professionals Who Can Make a Difference

In states where there are frequent earthquakes, many design professionals have adjusted their practices to reflect the risk. In areas where earthquakes occur only rarely, design professionals may focus more of their attention on snow and wind loads. National and international professional associations can influence their member engineers, architects, and builders to pay more attention to seismic safety issues. Regulators like building inspectors can direct more attention to seismic safety considerations. Those who participate in code development organizations can be reached by official spokespersons. Urban land use planners can take seismic hazards and risks into account when creating community plans or participating in decisions about transportation or housing projects, or other development initiatives.

Risk management professionals for public and private organizations can consider seismic safety in the decisions they make. Traditionally, risk managers have not focused much of their attention on reducing threats posed by natural hazard events, but professional practice appears to be changing. There is increased attention to reducing organizational losses from earthquakes, as well as from other natural events and willful acts. Insurers and market intermediaries, for example, financiers, can play critical roles in improving seismic safety. If insurers and lenders provided improved rates for buildings that are built to withstand greater seismic forces, owners would have greater incentive to design and build their structures that way.

Professional certification and licensing education and training programs can be modified to include appropriate material, whether offered through universities or professional associations. Professional associations can emphasize seismic safety practices in their regular conferences and workshops. Standards for peer review can incorporate attention to seismic safety.

Partnerships for Seismic Safety

Do not try to "go it alone." Successful seismic safety advocacy garners the support of other constituencies within the community. Emphasize the benefits from enacting seismic safety measures while building coalitions and networks capable of sustaining interest and action.

Understand How Different Stakeholders View Seismic Safety
Some stakeholders are active proponents of earthquake safety, but others are indifferent or actively oppose enhanced safety measures. Understand what motivates both supporters and opponents. Devise strategies for keeping supporters on board over the long run, neutralizing opposition to earthquake safety, and motivating those who are indifferent. Be willing to compromise and engage in political tradeoffs. Rather than holding out for ideal programs that have little chance of gaining support, gauge which seismic safety options have the best chance of being adopted and implemented under different circumstances.

Provide Incentives
Carrots and sticks make things happen. Incentives can include direct economic rewards, relief from regulation, subsidies of various kinds, low-interest loans, technical assistance, tax breaks, transfers of development rights, and public recognition and awards for those who support seismic safety. Worries about legal liability may also be a powerful motivating force for some stakeholders. Stress how measures taken to enhance earthquake safety help reduce other risks or provide secondary benefits. Champions and partners are important for moving policies and programs forward, but they also like to receive rewards and recognition for their support.

Link Seismic Safety to Issues People Already Care About
Earthquake safety shouldn't be only about earthquakes. Link it to other issues such as homeland security, economic sustainability, environmental protection, quality of life, livability, school safety, and historic preservation. Many of these issues already have organized constituencies that can be "co-opted" into supporting earthquake loss reduction. Sell earthquake safety to these groups by showing how seismic loss reduction yields benefits such as more open space, a charming historic downtown, or better preparedness for terrorism and bioterrorism.

Build Networks That Can Last
Strategies for enhancing earthquake safety must go beyond one-time educational campaigns and single ballot efforts to create long-term networks of seismic safety supporters. Build on existing networks—consisting both of the "already converted" and of groups that can be persuaded to put seismic safety on their agendas. Many groups have already identified themselves as advocates. Other potential candidates for membership in earthquake safety coalitions include structural engineers' associations, groups representing the design professions, building and safety officials, citizens' emergency preparedness groups, neighborhood watch groups, coalitions focused on neighborhood safety, improvement, and quality-of-life issues, victim advocacy groups

formed in the aftermath of other disasters, community colleges, and colleges and universities.

Get Experts in Your Group

Get to know university-based experts in the earth sciences, the social sciences, and engineering, as well as your local emergency management agency, other key governmental agencies, and important non-profit organizations like the American Red Cross. These ongoing partnerships will help bolster your case for enhancing seismic safety and lend credibility to your efforts.

Use Other Communities as Examples

Learn about and publicize what other communities are doing to address earthquake risks, and use their success stories to obtain support for the measures you are advocating. Get to know the champions in those communities; they can teach you about what to do and what not to do. Frequently, a mayor, city manager, or council member from a community that has adopted seismic safety measures can influence counterparts in a community that has yet to commit to seismic safety. Arrange talks or lunches during which the already converted officials can share their experiences.

Working with Experts

Every seismic safety advocate needs to draw upon experts from other fields. Some citizen activists may need lots of expert assistance. The advice below will help you find and use experts.

Draw on a Variety of Fields
One expert alone cannot possibly address all concerns regarding seismic safety. Useful experts may include geologists, seismologists, geotechnical engineers, structural engineers, lifeline engineers, urban planners, building officials, economists, lawyers, and emergency managers. Learn the differences in these fields of expertise in order to best match the expert to the issue at hand.

Find Credible Experts through Credible Sources
Because it might be hard to tell who is an "expert," you will need to do some investigating. To seek an appropriate expert, begin with credible sources: state geological surveys, local universities, or professional associations and their local or state chapters. Use experts who are respected in their profession and have proven to be credible to other audiences.

Question Your Experts
Do not hesitate to ask for explanations and clarifications from the experts you work with. If you cannot understand their points, neither will most audiences.

Use Enthusiastic Experts that can Persuade Others
Because you need the support of key professional groups, it is helpful to find experts who have the enthusiasm to mobilize the support of those groups. A network of experts can advance your issue more successfully than just one expert.

Don't Be Surprised When Experts Disagree
Experts often have opposing viewpoints on particular issues. What if another expert disagrees with your expert? If the experts you rely upon have good reputations and draw support from their professional networks, your chances improve of weathering controversy and convincing decision makers, the media, and the public. Acknowledge differences and then arrange a meeting among experts. A compromise position may be possible. The other experts may have valuable points, and incorporating them in your argument will only improve it.

An Opposing Expert Can Undermine Your Case
Experience shows that just one opposing expert, no matter how discredited his or her claims, can undermine a technically well-founded position. It is important to anticipate opposing arguments, and to vigorously and persistently stay with your course of action. However, stick to the facts and do not ridicule an opposing expert, as that will reflect badly on you or your expert's credibility.

Opposing Non-experts Can Be Trouble, Too

When confronted with the claims of unqualified "experts," you need to marshal your professional experts to counter the claims quickly, clearly, and comprehensively. Develop a convincing explanation and repeat it. Many self-proclaimed "experts" are not experts at all. Expertise in one discipline does not carry over to other subjects. Misrepresentation of expertise is particularly common in earthquake prediction.

Disagreement among Your Experts Looks Bad

Your own experts may have points of disagreement, given the complexities of the disciplines relevant to seismic safety. But airing those disagreements in public can undermine your case. Prior to making public statements, your experts should identify points of agreement upon which to base your position, and be willing to acknowledge points of disagreement, if necessary.

Reports Written by Experts Can Help Support Your Case

Although it is very helpful to have experts who will advocate publicly, you may not find willing participants at first. In the absence of living, breathing experts, cite credible reports. These come from government agencies, reputable consultants, or university professors. Reports on websites are easy to find, and sometimes useful, but Internet information is not necessarily reliable. Experts unwilling to become spokespersons may still give advice on the most appropriate and credible documents.

Effective Risk Communication

With the exception of some residents of California and a few other western states, most Americans have never been in a damaging earthquake, don't expect to, and see little or no reason to protect themselves against one. Even in areas where there has been extensive experience with earthquakes, seismic safety messages must be continually reinforced. As with any risk, people must be regularly encouraged to improve their safety. Well-crafted communications campaigns can help seismic safety advocates achieve those goals.

Before going Public, Develop an Overall Strategy

When communicating with the public, policymakers, decision makers, or any other audience about earthquake hazards, it isn't enough to focus only on the scientific information you want to convey. It is important to think about the following:

- the audience or audiences you want to reach,
- the distinctive characteristics and needs of those audiences,
- how to be seen as credible and trustworthy by those audiences,
- the best form for communicating scientific information on the earthquake threat (how the content of risk messages should be organized), and
- which media (print, electronic, face-to-face communication) and vehicles (news conferences, brochures, mass mailings, public meetings) will be most effective in reaching target audiences.

Know your Audiences

"The public" is very diverse, consisting of many different groups with different informational needs and retention capacities. A one-size-fits-all approach to communicating with them is almost sure to fail. Legislators, policymakers, private-sector decision makers, and the general public differ in their information requirements. Be prepared to express the same general point—that there is a significant earthquake risk—in many different ways for your various audiences. Consider what each audience needs to know to make good decisions about the earthquake threat. This will be based both on what you think they require and what they themselves may have expressed.

Be Credible

People will not act on information given to them by individuals and organizations they do not believe or trust, so analyze who would be the best spokespersons to communicate with different groups. Sometimes these spokespersons are well-respected earthquake experts, and they have gained the respect by adapting their message and delivery to various audiences. Do not assume that all experts can communicate clearly; many have trouble "speaking the language" of non-scientific audiences. When you do not have access to earthquake experts who can communicate well, find people or organizations that are credible to your audiences and ask them to serve as spokespersons for your earthquake-related messages.

The credibility of organizations and individuals can be harmed if they:

- take positions that appear to audiences to be unjustified, based on what those audiences already know,
- make statements that contradict what was said previously or that are inconsistent with information the audiences obtained from other sources,
- communicate about the earthquake threat in ways that appear to be self-serving, or
- gain a reputation for deceit, misrepresentation, or lack of full disclosure.

Once lost, credibility is difficult to regain.

Organize your Information to be Understandable and Memorable
Scientists are comfortable handling complex technical information, appreciating the implications of probabilistic statements, and retaining large amounts of data, but many other people are not familiar with such concepts. To make complicated ideas relevant, understandable, and interesting to non-experts, simple statements and good visuals are essential. Printed materials and brochures are appropriate for non-experts because they can be referred to as needed. In campaigns that rely heavily on radio and television, simple statements and repetition are especially important.

Tell People What to Do
Once you have people's attention about the earthquake risk, it is very important to explain to them what they can do to reduce the possible damages. Include in your messages not only information on concrete steps they can take to protect themselves, but also where they can go for more information—both on the earthquake risk and on the various loss-reduction measures you are recommending.

Use Multiple Media
Effective communications campaigns use mass media and person-to-person contact. They employ all types of media and a variety of information "vehicles" (press conferences, radio and television public service announcements, newspaper and TV feature stories, public meetings). Generally, people process information slowly. They base decisions on what they learn from the media after they have discussed it with their families, co-workers, and neighbors. Reinforce media messages through more personalized ways of delivering information, such as neighborhood meetings and school and workplace preparedness programs.

Be Consistent
Always keep messages consistent across different media and vehicles, and among diverse groups. Risk communicators have learned that, when people get contradictory pieces of information about what to do, they do nothing. They do not pick a favorite and get on with it. Consistency will require that you work closely and carefully with all your partners—individuals and organizations—but it is worth your while to do so.

Communication Tools

Various computer-based resources can be used to improve risk communication. By graphically demonstrating the potential losses from an earthquake in a local area, they can help people "see" the problems they may need to cope with. Geographic Information Systems (GIS) are convenient places to store basic data about the local environment—natural as well as built—and the local or regional infrastructure. Loss Estimation Models go a step further and allow for those data to be manipulated to show probable damages from earthquakes of specific location and magnitude. HAZUS MH is such a loss estimation tool developed by the Federal Emergency Management Agency. Using GIS technology, the HAZUS MH software allows users to project earthquake damages and losses to many structures: highways and bridges, schools, hospitals, and residences, as well as to estimate resultant deaths and injuries and potential medical care and shelter needs. Local groups can enrich the basic HAZUS MH data with locally specific data, thereby making the tool more precise in its projections. For more information on how to acquire and use HAZUS MH, visit FEMA's website: www.fema.gov/hazus.

Using the Media

Good relations with the media are essential for effective seismic safety advocacy. The public looks to the media as significant sources of information on earthquakes, earthquake preparedness, and earthquake policy. Media sources—newspapers, radio, TV, Internet—have the ability to influence public opinion and to place seismic safety on the policy agenda. This brief offers suggestions to those responsible for developing media strategies, as well as to those who may become spokespersons with the media.

ADVICE FOR MEDIA STRATEGISTS:

Before Contacting any Mass Media Source, Develop a Communications Plan
Establish a time frame reasonable for different media initiatives, taking into consideration both the time needed to develop media messages and important dates, such as earthquake anniversaries. Divide the labor, assigning responsibility for writing, speaking, arranging media contacts, and other tasks associated with a campaign. Select one or more spokespersons who will communicate directly with the media, making sure that they are both credible and comfortable interacting with the media. Your plan should cover approaches and messages during routine times before a disaster and the messages and strategies you may use after an actual earthquake event in your area or nearby. In advance, think about what you want to communicate, and when you want to do so.

Media Sources May Find You before You Find Them
If media representatives contact you before you are ready, say something. At the very least, thank them for their interest. Don't make things up. Don't let them pressure you because they have a deadline. If they ask you a question you can't answer, say you will check facts and get back to them. Do your homework quickly and then get back to them. Or recommend an expert who can answer their questions. Never say anything that would damage your cause or hurt your allies if it showed up in print.

The Media are Dizzyingly Diverse
There are more media outlets now than ever before, appealing to very diverse audiences. New media such as cable television and the Internet coexist with more traditional print and electronic media. Media usage is highly segmented, with different age, ethnic, and other social groups getting specialized information from various media sources. This variety makes launching public media campaigns extremely challenging, and potentially very expensive.

Media have Different Strengths and Weaknesses
Mass media differ in terms of what kinds of, and how much information can be conveyed, the impression the information is likely to make on audiences, and how easy it is for audiences to access and refer back to that information. They also differ in terms of "market share," in that some media (network television) reach a larger proportion of the public than others on a typical day. Additionally, media outlets differ in terms of the costs associated with delivering information. In crafting media campaigns, think through these differences carefully.

Understand the Needs of Different Mass Media Outlets
Establish long-term relationships with people who work in media organizations so that they will assist you in your work. View the media as collaborators in your advocacy efforts and work with media representatives in ways that make their jobs easier. Give the media representatives what they need and they will cover what you want them to. Many media work on very tight deadlines. Be flexible enough to handle the very short time frames associated with breaking news, as well as the longer time frames permitted by in-depth and feature stories. Television requires good visuals—always have some or be able to suggest great images. Local television news typically consists of short spots with short messages. More substance can be communicated in print than through electronic media.

ADVICE FOR SPOKESPERSONS:

Develop Skills that Enable you to Work Well with the Media

- Don't use scientific jargon. Learn to talk in plain and simple language.
- Don't be afraid to say that you don't know something, and don't feel pressured to respond immediately to difficult and complex questions that require more thought. If more information is needed in order to address a question, say so, and then get that information.
- Keep your message consistent, and remember what your audience needs to know.
- Don't let anyone divert you from conveying your message.

Adopt a Style that Enables you to Relate to your Audiences

- Be honest, but also speak and carry yourself in a way that conveys trustworthiness.
- Be genuinely responsive to concerns that are raised, even when those concerns seem outlandish or unfounded.
- Never treat the media or members of the public dismissively or convey the impression that you think their questions are trivial or silly.
- Allow yourself to act easygoing and approachable. Avoid appearing arrogant to audiences.
- Recognize and address the emotional dimensions of issues that are being discussed, especially in situations that involve controversy.

ADVICE FOR BOTH:

Manuals and Courses can Help you Deal with the Media
Developing good relationships with the media is hard work, but there is information available to help with a range of communications challenges, from speaking with reporters after an earthquake to formulating effective letters to the editor and opinion pieces for newspapers. You don't have to wing it. FEMA has training courses for media relations, as may your state office of emergency services. Local non-profits may be another source of training, along with university extensions and professional trainers. There are books too.

Further Reading

☑ About Earthquakes

Earthquakes, Fourth Edition, by Bruce A. Bolt. W.H. Freeman and Company, 1999:
http://www.whfreeman.committee/bolt

U.S. Geological Survey Earthquake Hazards Program website:
http://earthquakes.usgs.gov

U.S. Geological Survey National Seismic Hazards Mapping Project website:
http://geohazards.cr.usgs.gov/earthquake/index.html

☑ About Earthquake Loss Reduction

Association of Bay Area Governments Earthquake Preparedness website:
http://quake.abag.ca.gov

Earthquake Engineering Research Institute website: http://www.eeri.org

Federal Emergency Management Agency website:
http://www.fema.gov/hazards/earthquakes

Federal Emergency Management Agency, ***Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies***, How-To Guide #3**:**
http://www.fema.gov/fima/planning_howto3.shtm

☑ About Buildings and other Structures in Earthquakes

Mid-America Earthquake Center website: http://www.mae.ce.uiuc.edu

Multidisciplinary Center for Earthquake Engineering Research website:
http://mceer.buffalo.edu

Pacific Earthquake Engineering Research Center and National Information Service for Earthquake Engineering website: http://nisee.ce.berkeley.edu

☑ About Building Codes

International Code Council website: http://www.iccsafe.org

National Fire Protection Association, ***NFPA 5000*****:**
http://www.nfpa.org/catalog/Home/OnlineAccess/Access5000/Access5000.asp

Promoting the Adoption and Enforcement of Building Codes, by Robert B. Olshansky. Federal Emergency Management Agency Publication #313, 1998. Available from FEMA warehouse 1-800-480-2520

Seismic Considerations for Communities at Risk, Revised Edition. Building Seismic Safety Council, Publication # FEMA 83. Available from FEMA warehouse 1-800-480-2520

Federal Emergency Management Agency, ***Understanding Your Risks: Identifying Hazards and Estimating Losses***: http://www.fema.gov/fima/planning_toc3.shtm

☑ About Seismic Safety Policy

California Earthquakes: Science, Risk, and the Politics of Hazard Mitigation, by Carl-Henry Geschwind. Johns Hopkins University Press, 2001

California Seismic Safety Commission website: http://www.seismic.ca.gov

Natural Hazard Mitigation: Recasting Disaster Policy and Planning, by David R. Godschalk and others. Island Press, 1999.

Western States Seismic Policy Council: www.wsspc.org

☑ About Public Education

Disaster Research Center, University of Delaware website: http://www.udel.edu/DRC

Natural Hazards Information Center, University of Colorado website: http://www.colorado.edu/hazards

"Public Education for Earthquake Hazards," by Sarah Nathe and others. ***Natural Hazards Informer***, November 1999: http://www.colorado.edu/hazards/informer/infrmr2/infrm2wb.htm

Part Two:

Background Papers

Promoting Seismic Safety

Guidance for Advocates

Partnership Plan
FEMA Tri-Center Project on Developing Research and Experience-Based Guidance for Seismic Safety Advocates

Peter May
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This discussion paper attempts to flesh out key aspects of a partnership plan for the guidance for advocates. The general approach is a "partner model" where FEMA, based on materials that we develop, provides content to partner organizations. Those partner organizations provide their value-added to the content and develop and carry-out appropriate communication plans for delivering that content to relevant members. As discussed in this paper, two levels of partner organizations are envisioned: Lead partners and communication partners.

Role of Partners

Partners are more than simple disseminators of information. They help both to shape content and to mobilize interest among key audiences.

- What organizations are appropriate partners? Appropriate partners are those organizations:
    - for which membership constitutes a critical mass of potential seismic safety advocates;
    - for which there is a track record of providing educational outreach to members (e.g., through workshops or other forums); and
    - for which there is an expressed interest in undertaking advocacy training.
- To date, we have identified a number of potential partner organizations:
    - EERI – Earthquake Engineering Research Institute, core potential audience of earthquake engineering professionals
    - SCEC – Southern California Earthquake Center, outreach program to potential advocates in southern California
    - Natural Hazards Research and Applications Information Center, University of Colorado, Boulder – extensive network of state and local practitioners concerned with hazard mitigation and publisher of the *Natural Hazards Informer* publication series
    - American Geological Institute / Seismological Society of America – organizations involving a broad constituency of seismologists and earth scientists
    - State earthquake program managers – a key network of advocates that can be used to identify state-level organizations

- Multi-state earthquake consortia (i.e., CREW, CUSEC, NESEC, and WSSPC) – potentially reaching core group of advocates within each of their regions
- International Code Council (or one of the subsidiary organizations) – core potential audience of building officials,
- National Emergency Management Association and International Association of Emergency Managers – core potential audience of state (NEMA) and local (IAEM) emergency managers (for which it might be better to focus on earthquake managers as part of FEMA earthquake program)
- Public Entity Risk Institute– risk managers

- What would partners do? We envision two tiers of partners:
  - **Tier 1 – Lead Partners.** (We have identified EERI, SCEC, and the Natural Hazards Center, Boulder as potential lead partners.) These partners would be responsible for:
    - Establishing a communication plan for disseminating information about advocacy for seismic safety. This includes attention to audiences, potential forums (e.g., workshops, training sessions, use of organizational web sites), and multiple means of communication.
    - Modifying content of advocacy materials to reflect specialized needs and pertinent examples for the membership of the organization or audiences the organization plans to reach. Partners could put their logos on the guidance materials and disseminate the materials in ways that make sense for their members. Partners could add content to the materials that might include vignettes specific to the organization, first-person testimony (via video or actual presence), or greater substantive content in areas of particular relevance to the audience.
    - Design and conduct of workshops or other training forums on use of the advocacy materials.
    - Recruitment of participants.
    - Working with Tier 2 partners. Lead partners will also have potentially important roles in working with Tier 2 partners.
  - **Tier 2 – Communication Partners.** (The remaining organizations on the above list.) These are organizations with which FEMA or one of the lead partners work toward:
    - Making appropriately modified materials available to these memberships through their organization's websites, printed materials, or other means.
    - Holding workshops, as appropriate, as part of annual meetings or other scheduled events.

Role of FEMA

FEMA's role is to initiate and monitor the partnerships. This entails:

- Selection of and negotiation with lead partner organizations. We have discussed a couple of different types of arrangements:

    1. Single Lead Partner organization – FEMA developing an agreement with one organization that may be a partner organization or independent contractor. The lead entity would work with its own organization and other partners to carry out the program. This arrangement would require many of the administrative issues involved in carrying out the program to the lead organization. A determination of appropriate funding for the lead organization would need to be made.
    2. Multiple Lead Partner organizations – FEMA would develop agreeemtns with several organizations each of which would serve as a partner on more-or-less equal status. This entails a stronger administrative burden for FEMA but potentially allows for greater adaptation of materials to fit partner needs.

    Regardless of the organizational arrangements, it is reasonable to think about a phased approach for which the partner strategy is tried with one or two initial organizations. This will have the obvious benefits of working through administrative and substantive issues in carrying out the program. It will also have a demonstration effect, hopefully, in showing the benefits of the program to potential partners and their members.

- Provision of content in electronic and print form for use and modification by partner organizations;
- Technical assistance and review of partner-developed materials.
- Funding for initiation by Lead Partners and their Communication Partners of workshops, other forums, or other means of disseminating advocacy materials.
- Evaluation of the success of the advocacy training and the partnership approach with attention to monitoring of the extent of outreach among lead and communication partners.

Next Steps

- FEMA establishes commitments from appropriate lead organizations and work with them for developing communication plans.
- Solicit feedback about the guidance materials from lead organizations and modify as appropriate.

Other Issues

There are, of course, many administrative issues involved in identifying, selecting, and working with partner organizations. Separate from these are consideration of:

- FEMA's direct efforts to promote the advocacy skills. The advocacy materials could be placed on the (revamped) FEMA website or made available in other forms. In addition, the materials could be incorporated into some form of training as part of the FEMA Emergency Management Institute and other program-specific training programs.
- Additional materials to be developed. A variety of supplementary materials could be developed that include videotaped interviews and/or other background materials for the illustrative seismic safety advocates.
- Training of partner workshop leaders. Consideration should be given to the extent that workshop (or other forum) leaders in partner organizations would themselves need assistance in fleshing out details of various advocacy tips.
- Ownership of materials. This relates to both the legal question of ownership and the extent to which FEMA officially endorses the content and pedagogy of training activities by partner organizations.

Examples of Successful Seismic Safety Advocacy

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INTRODUCTION

This paper has several purposes. The first is to provide tangible examples to support the guidance advice in *Promoting Seismic Safety: Guidance for Advocates*. It can be viewed as providing the "illustrations" for that document. Second, as the first such collection I am aware of, it begins to identify some common themes of seismic safety advocacy. Third, I hope that these stories will serve as an inspiration to present and future advocates.

Why were these particular eight examples selected? I used three criteria to identify candidate examples:

- Collectively, the examples needed to represent different parts of the country and various levels of seismic risk.
- Each one needed to include a successful seismic safety action. This ruled out a few advocacy efforts that did not succeed, as well as several outstanding educational programs that have not (as yet) yielded an easily identifiable action. In two examples, I emphasized the work of prominent advocates, rather than actions, because their path-breaking efforts clearly led to a variety of actions.
- Each one needed an advocate or set of advocates who clearly played crucial roles in the success of the action.

Using previous publications, personal contacts, and on-line resources, we identified a list of 25 candidate examples. After preliminary research, this list was reduced to 12 examples that most clearly met the above three criteria. Because some of them were closely related, they were eventually combined into the eight examples presented here.

These stories exhibit a number of common themes. Collectively, they support most of the advice provided in *Promoting Seismic Safety: Guidance for Advocates.* In particular, all of them show the importance of persistence (and patience) and the value of seeking partnerships. Personal contacts are crucial; all the cases illustrate the importance of building personal networks, knowing whom to call, and establishing mutual trust with others in the field. They also show the importance of post-earthquake windows of opportunity; every action owes either its origin or a boost in support to a particular earthquake event. In several of the cases, community actions for seismic safety emanate from concerns about school safety, confirming that linking these two issues can be an effective way for advocates to advance seismic safety. Finally, several of the cases demonstrate how initial efforts and seed funding provided by FEMA and USGS can catalyze substantial community actions.

In these 12 successful examples, most of the advocates are dedicated public employees who go beyond the minimum requirements of their jobs. The next most common group of advocates consists of technical professionals and academics in engineering or the earth sciences. We also identified several legislators who took their charge seriously and became passionate advocates for the importance of seismic safety (the stories include accounts of two of them leaving hospital beds to ensure the success of their efforts). Citizen advocates—promoting seismic safety purely on a voluntary basis—are identified in only two of these cases.

The report presents the eight cases in geographical order, from northeast to southwest. I hope this will help readers first to appreciate the advocacy challenges and successes in the less seismically active parts of the country before reading the progressively more successful accounts in western states, culminating with three vignettes in California.

I would like to thank my two research assistants, Chisaki Muraki and Reshmi Thecketil, for their long hours of searching the internet, locating advocates (some of whom have retired), and creating a sense of order out of mountains of material. Finally, I thank the advocates for their hard work over the years and for generously giving their time to speak to us and to review drafts of their stories. For some of them I hope it was a positive experience to see a summary of all their accomplishments, cleansed of all the obstacles they are accustomed to seeing on a daily basis.

THE EXAMPLES

One
New York City Seismic Code and Building Inventory
A seismologist and engineer spearhead the effort to create a seismic building code for New York City and to inventory vulnerable buildings in Manhattan; the effort bears fruit after the attacks on September 11, 2001.

Two
Otto W. Nuttli
A dedicated seismologist single-handedly raised awareness of the New Madrid Seismic Zone.

Three
Seismic Safety Activities In The State Of Arkansas
Dedicated and persistent state employees helped to enact legislation and promote seismic safety

Four
Seismic Safety Legislation In The State Of Missouri
A reporter interested in seismic safety and a concerned legislator made a difference.

Five
Utah: School Retrofit, Seismic Safety Commission and More
Several dedicated advocates persevered over two decades beginning in the 1970s to gain support for seismic safety.

Six
Seattle, Washington: School Safety
A determined citizen advocate and a dedicated professional improved the seismic safety of Seattle's schools and increased community awareness of the earthquake threat.

Seven
Building Rehabilitation and Seismic Code Laws in Oregon
Sustained long term efforts by Oregon Seismic Safety Policy Advisory Council, staff of the state geologic agency, and a supportive legislator lead to successful passage of two ballot measures.

Eight
Advocacy Vignettes From California
I. Karl Steinbrugge: Seismic Safety Pioneer
II. California Seismic Hazard Mapping Act: Using A Window Of Opportunity
III. City Of Berkeley: A Community Champion Acts As A Catalyst For Action

<u>Example One</u>

New York City Seismic Code and Building Inventory

A seismologist and engineer spearheaded the effort to create a seismic building code for New York City and to inventory vulnerable buildings in Manhattan; the effort bears fruit after the attacks on September 11, 2001.

Seismic Hazard of New York City

According to a report by the New York City Seismic Code Committee, the seismicity of the New York City area is "moderate," with earthquakes of about Modified Mercalli Intensity VII occurring every 100 years. The last damaging event, with a magnitude estimated at about 5.2, occurred in 1884. Larger earthquakes, with Intensity VIII-IX, or Magnitude 5.75 to 6.75, may also occur. The seismicity of the New York City area is similar to that of the Boston area, which was affected by an earthquake in 1755, and has had seismic design requirements since the 1970s. In addition, New York City sits on a combination of solid bedrock and soft sediments (many such areas are artificial fill or former marshes); the contrasts in stiffness between these materials can cause significant amplification of ground shaking. The soft soils are also subject to liquefaction.

According to the New York Geological Survey, earthquakes of up to magnitude 6.0-6.5 are believed to be possible anywhere in New York State, and earthquakes of up to magnitude 7.0-7.5 are believed to be possible in southeastern New York. The state has experienced 16 significant earthquakes since 1853.

Action #1: New York City Seismic Code

New York City has its own building code. Because most other cities adopt updated versions of one of the model building codes, they are able to routinely adopt the latest seismic provisions of those codes. Such is not the case in New York City, which prior to 1996 had no seismic code.

Several forces in the 1980s led to an interest in a seismic code for New York City (this account comes from a report by the New York City Seismic Zone Committee, ca. 1999, and an interview with Klaus Jacob). One important trigger was that national seismic maps, such as those in ANSI A58.1 (1982) and ATC 3-06 (1978), were beginning to identify New York City as being in a seismic hazard zone. In the early 1980s, the New York City Building Commissioner asked the New York Association of Consulting Engineers (NYACE) to review the issue. They in turn asked for advice from a group of seismologists and engineers. This committee in 1986 concluded that New York's seismic hazard warrants concern, and in June 1987 the NYACE Board unanimously recommended that New York City adopt seismic design provisions modeled after those in the Uniform Building Code (UBC).[1]

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[1] This time period also included the disastrous Mexico City earthquake of 1985, as well as a M 4.0 earthquake in nearby Westchester County that was widely felt in New York City.

At the same time, what was then called the National Center for Earthquake Engineering Research (NCEER) was established at SUNY Buffalo. To initiate the work of this new Center, several workshops were held, starting in October 1987. Following an initial brainstorming workshop, NCEER funded a highly visible conference in New York City in February 1988, hosted by the New York Academy of Sciences and open to professionals and the media. This began to inform a wider audience of the seismic risk in New York City.

The increasing evidence that New York City was in UBC zone 2 (or its equivalent in other codes and standards) began to create concerns for practicing engineers, not the least of which was their liability if they ignored seismic design. In December 1988, the Armenia earthquake occurred, and NCEER held a briefing on the implications of this earthquake for New York City, which, like Armenia, had not constructed its buildings with earthquakes in mind. In February 1989, a TV reporter for the local NBC affiliate did a three-part, prime-time piece on this subject, based on interviews he had conducted with local seismologists right after the Armenia earthquake and a more recent interview with the New York City Building Commissioner. This TV coverage brought attention to the subject in general and created discomfort in the Commissioner's office in particular. In April 1989 the Commissioner appointed a Seismic Code Committee to draft the appropriate provisions. They submitted their report to the Commissioner in April 1991.

Although the technical work was completed in 1991, political resistance remained. The mayor and City Council dragged their feet on the issue, and in 1994 a Republican, Rudy Giuliani, took office. A similar process had been going on at the state level and the new Republican governor objected to a state building code, under the principle of regulatory reform. Klaus Jacob and others (more details below) decided to press the City on the issue, lest the effort wither away. Eventually, the Commissioner met again with the committee, and agreed with Giuliani to submit it to the Council. Longtime New Yorkers on the Council refused to believe that earthquakes are a threat to their city, but immigrants from South America, the Caribbean, and California, were concerned. With the support of these immigrants, the Council approved the code, the Mayor signed it in February 1995, and it took effect on February 21, 1996.

The Advocates: Klaus Jacob and Guy Nordenson

The December 11, 1995 issue of *New York Magazine* included, as its cover story, a lengthy article on "Waiting for the Big One" in New York. Over 80 people interviewed for the piece all agreed: "It's coming. They disagreed on how big, how devastating, how soon. But this, no one denies--we're going to see an earthquake. In New York City. And we're not ready for it."[2] Much of the article focuses on Klaus Jacob, a seismologist from Columbia University, stating that, "Jacob is the acknowledged leader of this tangled web of eastern seismologists, geophysicists, and engineers, many of whom have never

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[2] The article also contains a prophetically wrong quote by Tom Mullen, head of the New York Police Department's Office for Emergency Management: "We had the World Trade Center [referring to the 1993 bombing]. That was our rehearsal for an earthquake."

actually been through an earthquake." Jacob's colorful, down-to-earth quotes in the article give one hint as to why he has been influential. His energy and dedication are other important qualities.

Klaus Jacob joined Columbia University as a seismologist after receiving his doctorate from the University of Frankfurt, Germany in 1968. For about twenty years he pursued scientific research on seismotectonics and engineering seismology. Since the mid-1980s, he shifted his research first to probabilistic seismic hazard assessment and site response, then to disaster loss estimation and mitigation research. Thus, over the years he gradually shifted from purely scientific concerns to issues of public policy. This evolution is now complete, as he currently is teaching at Columbia's School of International and Public Affairs on human dimensions of disasters. According to Jacob, this shift came about partly from experiences in seeing the results of disasters. But the key moment was his involvement in developing the proposal for NCEER and helping to launch the new organization. The latter is an important point for seismic safety advocacy: the creation of such earthquake institutions provide forums, credibility, and funding for the advancement of seismic safety.

Interest in earthquakes in New York actually began a few years before the advent of NCEER. The New York State Emergency Management Agency (NYSEMO) began to perform some earthquake scenarios for upper New York state. At the same time two key personnel changes brought earthquake program managers to the FEMA regional office (Bruce Swiren) and NYSEMO (Dan O'Brien). That both are still in those positions twenty years later has provided important continuity in the work of these agencies and their contacts throughout the state.

At about the same time, in the early 1980s, Klaus Jacob became chair of the NYSEMO Technical Advisory Committee. He prepared a plan for a thorough assessment of earthquake risk in New York (both the state and the city). Although the $3 million price tag was too high at the time, development of this plan was a worthwhile exercise both because it provided a vision of how to complete this important task and because many years later some funding became available.

Around the time of the formation of NCEER, Jacob became acquainted with Guy Nordenson, a consulting structural engineer who had recently moved from California. According to Nordenson, he had never felt comfortable limiting himself to the narrow technical aspects of engineering. While in graduate school in California, he was losing interest in the field until he discovered the Structural Engineers Association, a group of engineers who were concerned with the social, political, and economic aspects of their work. When he returned to the east coast from California in 1982 he carried these interests with him, hoping to eventually create a similar organization in New York. This eventually occurred (see below), but it took many years to accomplish.

Nordenson's move to New York in 1982 coincided with the new ANSI standards that increased the seismic considerations for the New York City area. Nordenson became actively involved in the NYACE's review of the issue for its implications for New York

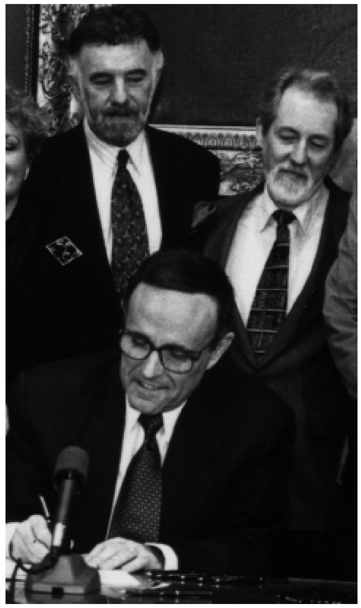
City's building code. He eventually took the lead of the committee designated to perform the review, and he is the lead author of the 1987 final report of the "Seismology Liaison Committee" to the NYACE, entitled *Seismic Hazard Evaluation for New York City*.

As noted above, the advent of NCEER was a crucial event, according to Jacob. It provided an organizational mechanism for discussing seismic risk, facilities for meetings, and credibility for its products. Suddenly, seismic safety advocates had an institution with stature. In the words of Jacob, because they now had an orchestra they could start playing symphonies. The set of highly visible workshops in its early years provided a foundation for public consideration of seismic risk in New York City. NCEER also provided outreach services and was a source of information to the public. Jacob estimates that he gave over 20 talks to a variety of professional organizations who made speaker requests largely through NCEER. Robert Ketter, the founding director of NCEER, was astute in positioning his new organization to provide meaningful information for the region. The work by NCEER and the work by New York City engineers nicely dovetailed during the late 1980s, each reinforcing the other.

When the New York City Seismic Code Committee was formed in 1989 by the Commissioner of Buildings, Nordenson was appointed chair of the committee, and Jacob headed the Geotechnical Subcommittee. The Committee and its subcommittees put considerable effort into developing a consensus code over the next two years. Their work included reports by several subcommittees as well as a trip to see the effects of the 1989 Loma Prieta earthquake. As described above, the Committee completed its work in April 1991 and submitted it to the Commissioner of Buildings.

According to Jacob, the committee made a concerted effort from the start to involve all interested parties. They identified potential opponents (primarily from the real estate industry) and invited them to participate. This allowed the committee to address the concerns of all stakeholders. Conversely, the development industry realized that they would all benefit from safer buildings. In the end, the final product had a larger base of support, and organized opposition was reduced.

By 1994, Jacob, Nordenson, and the others had become increasingly concerned about the lack of progress in City approval of the code, which they had completed three years previously. This concern was underscored by the Northridge earthquake of January 1994, as well as by the changes in administration both in New York City and in Albany. Jacob, as a member of the seismic code committee, decided to help force the issue by visiting the new Building Commissioner. In his meeting with the Commissioner, he argued that Presidential Executive Order 12699 required all federal agencies to incorporate seismic safety measures for all federal buildings starting in 1993. This was a clear federal commitment to seismic codes. Thus, to best facilitate the possibility of federal investment in local buildings, New York would be well advised to adopt a seismic code. In addition, existence of an acceptable seismic building code would facilitate receiving federal relief funds after a disaster. This financial argument was persuasive. Shortly thereafter, the Commissioner contacted the Code Committee, met with the mayor, and submitted the code to the City Council. As described above, the Mayor approved the new code in February 1995.[3]



Mayor Giuliani signs Local Law 17/95, New York City Building Code, 21 February 1995, flanked by Klaus Jacob on the right

According to Jacob, the initiation of the new code in 1996 went very smoothly. He attributes this to the broad awareness and support developed in the engineering community over the years (12 years since the effort first began!). The Code Committee continued to meet through 1997 to help the Building Department formulate guidelines for code implementation.

Furthermore, completion of the new seismic code (and the culmination of the work of the 31-member Seismic Code Committee) finally provided the appropriate moment for the creation of the Structural Engineers Association of New York (SEAONY) in 1996. Nordenson was a co-founder of this organization, and became its second president in 1997. Creation of this organization was later to prove to be an additional benefit to New York City.

Action #2: The New York City Area Consortium for Earthquake Loss Mitigation (NYCEM)

In about 1998, Bruce Swiren of FEMA dusted off Klaus Jacob's old proposal for earthquake risk assessment of New York. With FEMA's renewed interest in mitigation, as well as their interest in funding pilot HAZUS earthquake loss estimates, FEMA was

[3] This signing date had been set the previous December, so it had no relationship to the January 1995 Kobe earthquake. Still, the recent earthquake helped everyone to feel more confident that they were doing the right thing, and it also facilitated implementation of the code.

able to provide $250,000 to initiate a partnership of FEMA, MCEER (NCEER, renamed), NYSEMO, Columbia University, Princeton University, the New Jersey Office of Emergency Management, and other relevant organizations. With MCEER coordinating the funding to the universities, the purpose of the project was to initiate an earthquake loss estimation for the New York metropolitan area. The initial objective was to characterize risk for Manhattan below 59th Street, with parallel efforts for northern New Jersey and downstate New York. An important purpose of the partnership was to promote private-public cooperation to increase regional appreciation for preparedness and response planning.

The key research participants were:

> **Columbia University's** Lamont-Doherty Earth Observatory, led by Klaus Jacob. They used data from over 150 geotechnical borings to create a census-tract based soil map for Manhattan. **City College of New York**, led by George Mylonakis, surveyed 600 buildings in Manhattan to provide additional validation of the building inventory.
>
> **Princeton University**. This team consisted of Guy Nordenson (by now a professor at Princeton, as well as principal of his own consulting firm), George Deodatis, Michael Tantala, and Amanda Kumpff. They used a combination of Department of Finance data and field surveys to create an inventory of 37,000 buildings for Manhattan.

In addition, loss estimates were performed by respective state agencies for Westchester County, New York, and parts of New Jersey.

The Consortium issued a report in 2001, held a number of workshops, and continues to maintain a website. A key purpose of creating the Consortium was to create networks and partnerships that could improve regional preparedness and communication. This investment paid off following September 11, 2001.

Application: September 11, 2001

Jacob and colleagues had presented the NYCEM findings to the City Office of Emergency Management in August 2001. According to Jacob's recollection, OEM was particularly impressed with the issue of how to clear away hundreds of millions of tons of debris. As it turns out, the briefing was held in World Trade Center #7, in the emergency operations center that was supposed to be self-sustainable for one month. One month later it was to collapse on the afternoon of September 11.

The aftermath of September 11 presented several engineering challenges. First was the need to perform rapid safety inspections of buildings. Second was the need to assist with search and rescue, demolition, and site safety. Third was the need to perform a more substantial inspection of buildings in lower Manhattan. The Structural Engineers Association of New York was just the organization for the job, post-earthquake inspection methods were the most appropriate available tool, and the best available database was the NYCEM building inventory. The following account comes primarily from: remarks by Nordenson at a commemorative assembly at Princeton University on the first anniversary of the attack, an article from the *Princeton Weekly Bulletin* (Dienst, 2001), and an article in the November 2001 *ATC News Bulletin*.

Nordenson (whose office was one block from Ground Zero) began to contact SEAONY colleagues on the afternoon of September 11 to discuss how they could help. By Friday the 14th, they had mobilized 100 engineers to help out around the clock in small teams in various parts of the site. They were there to advise on safety, demolition and whatever else needed their expertise. When Nordenson visited the site that day, he observed that no one knew how to go about inspecting the surrounding buildings, which clearly need to be done. He realized that he had all the ingredients at his fingertips: knowledge of the ATC-20 post-earthquake inspection procedure, a database of all the buildings, and a team of qualified engineers. Within 24 hours he had approval for the work, ATC had shipped 200 copies of their field manual from California, and he spent the weekend mobilizing teams of four to five engineers and a chain of command that enabled them to start work on Monday. By Tuesday, they had completed preliminary inspection of 400 buildings, assisted by current aerial photography being taken daily. They (Princeton graduate students, experienced with the NYCEM study) then merged the results with their existing building databases in order to present the information visually to decision makers. On Wednesday the 19th the team presented preliminary results to the Department of Buildings. Most buildings were found to be safe for occupancy, but about 30 required a closer look. They prepared new, detailed checklists for these 30 buildings, and dispatched four new teams to complete the inspections on Friday. By the end of the day on Friday the 21st they had completed a full report of 415 buildings: 384 were safe for occupancy, 18 had moderate but repairable damage, nine had major damage and required restricted access, and four were partially collapsed. This work was invaluable in helping emergency personnel to focus their efforts. Teams continued to work on the site, with 16 teams alternating 12-hour shifts every three days, until January 2002.

The NYCEM effort produced other less measurable benefits as well. The partnerships provided channels of communication that were useful in the days and weeks following the attacks. The inventory and the earthquake loss estimates provided a point of reference that made it easier for officials to estimate how much financial assistance to provide to New York. And a variety of other considerations, such as the issue of debris removal, had at least been introduced to emergency management officials.

Lessons for Advocates

- Take advantage of windows of opportunity to advance the cause of seismic safety. Many such windows—often serendipitous—opened in this case: earthquakes, opportune meetings with key people, chances to present results to a key audience, chances to organize a seminar or workshop that can garner interest from relevant sources, sudden attention by the press, and so on. You need to be prepared to step in when such opportunities present themselves. September 11 presented an opportunity to apply many of the achievements of the seismic safety efforts. It, in turn, helped to prepare New York City for other disasters (natural disasters, we hope) in the future.

- Formulate sound and well justified proposals for future action and funding, even when there is little chance for immediate support. They can be used when unforeseeable windows of opportunity open in the future.

- Earthquakes elsewhere help to boost your message. The earthquakes in Mexico City in 1985, Armenia in 1988, Loma Prieta in 1989, Northridge in 1994, and Kobe in 1995 all helped the seismic code effort.

- Personal contacts are important. In the end, it is networks of people that get things done. Jacob says that he learned that a handful of people can put their heads together and accomplish much. At many points in all his efforts, he was able to draw upon long-term relationships and acquaintances developed over the years.

- Institutions are important. NCEER provided a credible forum, a voice for seismic safety issues, and funding for a variety of seismic safety efforts. NYCEM has provided a voice for a united effort and also a mechanism for inter-agency and inter-jurisdictional communication and cooperation. (It is gratifying for FEMA and NSF to see that the seed money they invest in these institutions pays off.)

- Professional networks are important. SEAONY and NYACE provided credible sources of expertise as well as mechanisms for mobilizing technical talent for the tasks at hand. It is also important to use professional networks to build a constituency for action.

- Take the initiative to meet with key decision makers. If you don't talk to them, they won't know of the earthquake problem. If you don't talk to them about seismic safety, who will?

- Present arguments in terms the audience understands (often, this is in financial terms).

- Identify potential opponents, gain their perspective, involve them in the decisions.

- Think of connecting the needs of people, advises Nordenson. Understand their needs as well as your own needs, and find opportunities to solve their problems.

- If you are a scientist or engineer, don't be afraid to jump into the policy arena. Jacob, Nordenson, and others are all technical specialists with broader social interests. They were able to successfully mix these talents and interests over the years.

- If appropriate, you should refer to national standards and those of nearby states. It is persuasive to argue that your jurisdiction is not following widely-accepted standards. Liability issues implicitly lurk behind.

- The press can be very helpful in publicizing your cause, but use them wisely and with caution. In this case, they were very effective in gaining the attention of decision makers. Professional organizations, no matter how credible, simply do not have the same influence on the voting public as the media. But, as Jacob warns, you never know what the media reports will look like, and you always run the risk of having them misrepresent the facts.

- With regard to the media, Jacob has another tip: it helps to have consensus among professional networks before you tip off the media to a story. In other words, it is comforting to know that if the media interview 80 people the story will be quite consistent.

- Persistence and continuity pay off. It took approximately 12 years of effort to adopt the New York City seismic code. It took approximately 15 years from the initial idea of a seismic risk analysis of New York City to the inception of NYCEM; it will take many more years to complete the effort. The persistence and continued presence of Jacob, Nordenson, Swiren, O'Brien and others has enabled this progress (however slow and frustrating it has been) to occur.

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<u>**Example Two**</u>

Otto W. Nuttli

A dedicated seismologist single-handedly raised awareness of the New Madrid Seismic Zone.

The central United States is a region with a low probability of damaging earthquakes, but the consequences of an earthquake could be severe. Scientists have long known about the great 1811-1812 earthquakes in the New Madrid region, but popular knowledge of them over the years has amounted to little more than folklore. In a 1912 U.S. Geological Survey Bulletin published 100 years after these events, Myron Fuller wrote, "although scientific literature in this country and in Europe has given it a place among the great earthquake of the world, the memory of it has lapsed from the public mind." If this was true in 1912, it is certainly true today, particularly because the last major earthquake in the region occurred in 1895.

Despite these obstacles to earthquake awareness in the region, the last two to three decades have seen a resurgence in scientific and public interest in the seismicity of the New Madrid area. The U.S. Geological Survey began a series of investigations in 1973, and the Nuclear Regulatory Commission subsequently provided funding to assist in this effort. The results of this work were summarized in a 1982 U.S. Geological Survey Professional Paper. The 1977 National Earthquake Hazards Reduction Act provided further continuing funding for research and regional workshops. Efforts by FEMA and state emergency management agencies led to the creation of the Central U.S. Earthquake Preparedness Project in 1981, and that same year saw the first conference focusing on earthquakes in the central and eastern U.S. In 1984, seven states formed the Central U.S. Earthquake Consortium (CUSEC). The Tennessee Earthquake Information Center (now Center for Earthquake Research and Information) was formed at Memphis State University in 1977. And extensive research in the region is now conducted by the seven universities of the Mid-America Earthquake Center (MAEC), formed in 1997.

What made all these efforts begin in 1973 and 1974? It is no coincidence that 1973 was the year of publication of Otto Nuttli's paper, "The Mississippi Valley Earthquakes of 1811 and 1812; Intensities, Ground Motion, and Magnitudes," in the prestigious *Bulletin of the Seismological Society of America.* This paper, and related work by Nuttli, profoundly affected seismic safety awareness and preparedness activities throughout the region.

Nuttli's Research

In the early 1970s, earthquake awareness in the Central U.S. was minimal, according to a monograph by the Committee on Preparedness, Awareness, and Public Education of the 1993 National Earthquake Conference. Not only was public awareness low, but scientific knowledge had not advanced since Myron Fuller's 1912 study. The term, "New Madrid Seismic Zone," did not exist.

Otto Nuttli, a seismology professor at St. Louis University, stepped into this void. He meticulously gathered information on effects and locations of historic earthquakes in the region. By studying the observations recorded in newspapers and journals, Nuttli estimated the locations, magnitudes, and areas affected by the three largest events in the 1811-12 New Madrid earthquake sequence. He estimated that the New Madrid earthquakes over a five-month period in 1811-1812 had Richter magnitudes as high as 8.0 to 8.8 and that the magnitudes of 15 to 18 of the aftershocks ranged from 6.5 to 7.0.

He also compiled an extensive database of Central United States earthquakes that have occurred in historic time. His historic research, informed by his seismological knowledge, enabled Nuttli to make estimates of earthquake activity in the Central United States: magnitudes, general location, and average number of years of recurrence for large earthquakes. His work also clearly demonstrated that earthquakes in this part of the country affect much larger areas than earthquakes of similar magnitude in the western U.S.

Nuttli was an outstanding seismologist, and was duly recognized by his peers. He served as President of the Seismological Society of America in 1976-77 and received the Medal of that society in 1987. But his influence went beyond that of just a scientist.

Nuttli's Public Awareness Activities

Otto Nuttli took it as his personal mission to increase awareness of the earthquake threat posed by the New Madrid Seismic Zone. Although we were unable to find any records of dates and locations of his presentations—nor could we find any estimates of how many public talks he gave—everyone in this field speaks of Nuttli's tireless efforts to spread the word. Everyone who began working on Central U.S. earthquakes in the 1980s cites the publications and public presentations by Nuttli at that time. His popular monograph, "The Effects of Earthquakes in the Central United States," published by CUSEC in 1987, has been subsequently republished and is currently available via several internet booksellers. According to the Committee on Preparedness, Awareness, and Public Education of the 1993 National Earthquake Conference, "More than any other individual, he began public awareness, education, and preparedness efforts in the central United States."

Sadly, we could not speak with Dr. Nuttli, because he died in 1988, at the peak of his career. In a memorial published in the *Bulletin of the Seismological Society of America* in June 1988, his colleague Brian Mitchell wrote,

> Otto's gentleness and accessibility extended beyond his dealings with professional colleagues. He received numerous phone calls and much correspondence from residents of the St. Louis area, some of whom might have an irrational fear of an impending earthquake. Otto would always listen patiently and, if necessary, would attempt to allay their fears. He gave freely of his talents and time regardless of the station of the person with whom he was interacting.

When he passed away in 1988 Nuttli left a legacy that inspired various geologists and earthquake safety advocates throughout the country to take up the cause of seismic safety.

Nuttli's Legacy

Nuttli's research on the danger of earthquakes in the central United States not only increased awareness but also led to the establishment of various organizations. His research contributed conclusive evidence that led seven states to form CUSEC. Over the past two decades, CUSEC has held frequent conferences and workshops throughout the region, designed to help earthquake preparedness and mitigation activities by professionals in the member states. Some of their recent activities have included promoting disaster resistant communities, formation of a transportation task force and development of a New Madrid housing recovery initiative. Nuttli's work also continues through the work of the Mid America Earthquake Center, of which Saint Louis University is a charter member.

Advocates can help to inspire others to take action. Otto Nuttli has had this effect in the central U.S. Among the advocates influenced by Nuttli, two deserve mention: Jim Beavers and Corrine Whitehead.

In the 1970s Jim Beavers, while working for the Union Carbide Corporation at Oak Ridge, Tennessee, was given the responsibility of developing a project proposal for a hazardous chemical facility. For this he needed more information on the seismicity of the New Madrid area, which led him to the work of Otto Nuttli. Inspired by Nuttli, and realizing the significance of increasing understanding of New Madrid seismic hazard, he organized the first National Earthquake Conference in Oak Ridge, Tennessee in 1981. The purpose of the conference was to understand seismic safety, spread awareness, and exchange information. In 1993 he organized the 2nd National Earthquake conference, with funding from FEMA. These two conferences not only spread the knowledge about earthquake hazard in the central United States but also served as a common platform for the exchange of ideas and information between academia and the practitioners in several fields. He continues to work as an active earthquake safety advocate, most recently with the Mid-America Earthquake Center.

Corrine Whitehead, a citizen activist with the League of Women Voters in western Kentucky, was also influenced by Dr. Otto Nuttli. After reading one of his publications in 1980, she contacted the state Division of Disaster and Emergency Services (DES), whereupon she discovered that the state was totally unprepared for a major earthquake. The League then captured the attention of the director of DES, and both organizations sponsored a series of meetings in the region. The DES director at the time, Wilbur Buntin, was, by all accounts, a prime mover behind Kentucky's early earthquake preparedness efforts. He convinced the Governor to appoint a task force to examine the hazard and make recommendations. This was the forerunner of what became a permanent advisory panel in Kentucky, and it was the first such organization in the central U.S., preceding the advent of CUSEC.

These two cases illustrate how Nuttli's work led to a chain of activities by others. We are sure that there are many more examples of advocates inspired by Otto Nuttli, as well as advocates in turn inspired by them. It is rare that one individual can have such an effect, and should serve as an example for others to follow.

Lessons for Advocates

- Nuttli's research reshaped the way we think about seismic hazard in the central U.S., and as such it catalyzed policies and funding for both research and mitigation activities.

- Awareness building alone can affect public perception and public policy actions. In this case, it is because Nuttli combined scientific credibility with a clear message

- Perseverance pays off—both in research and in building public awareness.

- Scientists *can* have an effect. Nuttli combined publicly accessible research with a drive to communicate it to the public.

- His work led to the development of institutions. These, in turn, have been able to extend the efforts, maintain public awareness, increase credibility of the message, develop and promote solutions, and build off of previous successes.

- Advocates can inspire others to become advocates.

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<u>**Example Three**</u>

Seismic Safety Activities In The State Of Arkansas

Dedicated and persistent state employees helped to enact legislation and promote seismic safety

The Actions

In 1989 and 1990, the Arkansas legislature enacted two pieces of legislation, establishing a state earthquake program and requiring seismic design of public buildings:

> **Act 247 (1989)** established a State Earthquake Preparedness Program within the Office of Emergency Services (OES). It also required the full cooperation of all state and local government agencies, departments, offices and personnel to accomplish effective earthquake mitigation, preparation, response and recovery capabilities.
>
> **Act 1100 (1991)** was an act to "safeguard life, health, and property by requiring earthquake resistant design for all public structures to be constructed or remodeled within the boundaries of this state beginning September 1, 1991." The act requires that all "public structures" (buildings open to the public as well as all public works) be designed to resist seismic forces, in accordance with the minumum requirement of the latest edition of the SBC. Although the state already has a building code, Act 1100 legislatively underscores that the state requires seismic design, establishes zones more explicit than those in the SBC, and sets forth penalties for noncompliance.

These two actions were part of a larger set of seismic safety activities that both preceded their enactment and continue to the present day. We highlight these two pieces of legislation, however, because they represent successful mobilization of a coalition that persuaded both the state legislature and the governor to enact these important statements of statewide policy.

Enacting the Legislation: Two Key Players

Both of these pieces of legislation owe their success to many people who helped write and support the two bills. Furthermore, Act 1100 was successful in part because it occurred during a time period of heightened earthquake awareness, owing to the 1989 Loma Prieta earthquake and ensuing New Madrid earthquake "prediction" by self-proclaimed expert Iben Browning. Even so, two key people stand out among all the supporters as being critical to the introduction and enactment of the bills, as well as to continued seismic safety activities in Arkansas.

Dan Cicirello has run the earthquake program in Arkansas OES since 1984. As an active contributor in the field of emergency service since 1965, Cicirello was the perfect point man of the OES. His expertise in nuclear war response was useful in application to earthquakes, because both are similar in having widespread consequences. Beginning in December of 1984 he gained the assistance of a newly-formed Governor's Arkansas Earthquake Advisory Council, which was established by Governor Bill Clinton. At the encouragement of FEMA, OES (and Cicirello) had promoted the formation of this Council and convinced the Governor of the need. It began with 17 members, eventually growing to nearly 40 by 1991 and 45 by 2002. Members consist of representatives of state agencies, utilities, universities, hospitals, local agencies, and other interested parties. Cicirello coordinates and staffs its meetings, which occur at least twice a year. It provides a forum for most of the major constituencies to get together and exchange ideas, alert one another to the latest news in the field, and boost each other's morale. It brought concerned professionals together into a network. Its large size is helpful because it provides for cross-fertilization among a variety of professions and interests. Furthermore, when they need to convince key actors about the importance of seismic mitigation, the message can come from many different sources.

The ideas for Act 247 and Act 1100 originated in the Advisory Council. Several key members were responsible for drafting Act 1100, and Dan Cicirello is the person who wrote Act 247. Without the Advisory Council, neither act would have happened. In particular, the Council developed the idea for Act 1100 several years earlier, prepared drafts of the bill, and argued for seismic codes whenever members gave public presentations. It was a long-term strategy to create both public and professional support.

Arkansas Earthquake Advisory Council
Source: Dan Cicirello

John David McFarland was the Chair of the Advisory Council at the time of these bills, and he is still Chair today. He works for the Arkansas Geological Commission, and he became involved in the Advisory Council because of his work in geological education. For many years he has spoken to civic clubs and school groups regarding geological issues in general and earthquakes in particular. When FEMA began to encourage OES to develop earthquake preparedness materials, McFarland became OES's source of information within state government. As McFarland puts it, he became Chair of the Council because he knew more about earthquakes than anyone else.

The Advisory Council agreed early on that they should place priority on a bill to improve implementation of seismic codes in Arkansas. After articulating a strategy, the members started to give talks to civic and professional groups to draw statewide attention to the importance of seismic design. Because of the heightened earthquake concerns in 1990, they saw their window of opportunity to pass the bill. McFarland completed the final draft and moved into action.

Every bill, of course, needs a legislator to introduce and promote it. In this case, the Advisory Council had a legislator as part of their group. The Governor appointed Rep. Owen Miller to the Council when it formed in 1984. This is a common practice for state earthquake advisory councils, because it provides them with a legislative contact. Rep. Miller was an obvious choice, because he is a lifelong resident of the most seismically active part of the state, near Marked Tree. Rep. Miller had long been aware of the state's earthquake risk, and was glad to participate. Rep. Miller sponsored both Act 247 and Act 1100 in the legislature.

Act 1100 required the active involvement of McFarland, Cicirello, Miller, and others. Both bills also enjoyed the support of the Director of OES, James Lee Witt, who was able to personally meet with legislators on the floor. According to McFarland, Act 1100 required constant "baby-sitting"; he had to be ready to respond instantly to any questions from legislators. After the bill passed the legislature, and only three days before the end of the legislative session, a key group identified an objectionable clause and asked for a veto. Through personal intervention, the Advisory Council was able to save the bill. McFarland personally took the bill from the Governor's office, and Miller personally walked the amended bill all the way back through the legislature (three days after receiving triple heart bypass surgery). This was an impressive achievement.

In the end, neither bill received any negative votes. This was gratifying evidence of the broad support the Advisory Council had gained for both measures, both from the public and from key interest groups. McFarland claims to be a scientist who lacks political skills. We respectfully disagree.

Other Factors

It is true that policy change and implementation are collective efforts, and they depend on the confluence of various forces. In this case, FEMA provided the framework for facilitating Arkansas to begin an earthquake program and establish an Advisory Committee. And the Committee, in turn, was able to institutionalize seismic safety as a goal of the state and of all the interests represented on the Committee.

But other external influences were important as well. If not for the work of Otto Nuttli and the subsequent research efforts by USGS, FEMA would never have focused any attention on seismic safety in Arkansas in the first place. And, as regrettable as was the hysteria surrounding the 1990 Browning earthquake "prediction," it was this climate of earthquake concern that provided the Advisory Council with its opening to enact Act 1100. More recently, FEMA's Project Impact program has brought funding to encourage mitigation in Arkansas.

Current Activities

The work of Cicirello, McFarland, and the Council did not stop in 1991, although the Acts set important precedents to facilitate future seismic safety enactments. Cicirello is proud of his work on disaster safety in schools over the years, and this work continues. The Council's latest initiative is to develop incentives to encourage the public to build disaster resistant homes.

In addition, every two years (when the legislature meets), Cicirello and McFarland find themselves standing in front of the House and Senate to defend the Building Code from those who want to weaken it. They also must continually work on keeping officials and engineers informed regarding implementation of the seismic code.

For Act 247 and Act 1100, as well as for the continuing efforts of Rep. Richard Simmons, the Western States Seismic Policy Council in 2000 presented one of their annual awards to the Arkansas State Legislature. This award also recognized the continuing vigilance of Simmons and the Council in maintaining the effectiveness of Act 1100 in the face of constant amendment attempts. Simmons also was instrumental in writing and sponsoring legislation that appropriated $125,000/year for the Arkansas Center for Earthquake Education and Technology Transfer, housed at the University of Arkansas at Little Rock. Until recently, Simmons was the legislative member of the Advisory Council. Although he lost his legislative seat due to term limits, he remains an active member of the Advisory Council.

One More Story: Partnership in Clay County

Clay County (population about 17,000) in 1997 was the first county in Arkansas selected for FEMA's Project Impact. This was because they were seeking mitigation assistance following an ice storm and flood. With the assistance of Dan Cicirello and Rep. Simmons, County Judge Gary Howell was successful in obtaining FEMA funding and in receiving technical assistance from the University of Arkansas at Little Rock (UALR). The County received $5 million from FEMA, and the Clay County Disaster Resistant Community Council, a volunteer organization, leveraged it into a number of activities throughout the community. They emphasized earthquake safety of schools, hospitals and businesses, as well as increasing community awareness. Their work included preparing a county hazard mitigation plan (done by several groups at UALR), installing earthquake-sensitive gas valves on all school buildings, and completing a seismic engineering survey and structural seismic retrofits for the school districts.

Their enthusiasm and broad community support have made the Clay County effort a model project frequently cited by FEMA and by CUSEC as an example for other communities in the region. Its success came from the technical assistance from UALR, the State and FEMA. More importantly, it also came from the dedication of the local council and from Judge Howell, who credits his success to "a lot of chicken dinners" that he paid for at his home, in order to encourage people to join and continue participating in the effort.

Lessons for Advocates

- Educate and inspire the public. This can provide an important foundation for future efforts.
- Develop a long-term strategy, and be patient and persistent in pursuing it.
- Develop and maintain personal contacts with key individuals who can help in the long run. Seek support from the public and from important professional groups.
- Find and cultivate other advocates.
- Learn from one another in your network. The Advisory Council works as a forum for information exchange, moral support, and formulating new ideas.
- Advisory councils or commissions are highly effective ways of institutionalizing seismic safety concerns and building a constituency for seismic safety.
- Be patient, and maintain your energy and enthusiasm.
- Be prepared with drafts of programs or policies, and take advantage when windows of opportunity open up.
- Work on communication and building partnerships.

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<u>Example Four</u>

Seismic Safety Legislation In The State Of Missouri

A reporter interested in seismic safety and a concerned legislator made a difference.

Background

In a community with problems such as financially strapped public schools, guns in schools, drugs, and teenage pregnancy, seismic safety was not an easy sell. Yet, a St. Louis reporter was able to increase public awareness of seismic safety, and a state legislator was able to lead the enactment of two key pieces of legislation. In July 1990, the Missouri General Assembly passed the Geologic Hazard Preparedness Act (S.B. 539), which addressed seismic building codes, earthquake emergency procedures for schools, and geologic hazard assessment. In 1993, Missouri legislatively established a seismic safety commission. The bill (SB 142), signed by the Governor on June 25, 1993, created a 17-member Seismic Safety Commission, including two legislators and public members representing 15 specified professions. It is highly unlikely that these two legislative acts would have been achieved without the key efforts of William Allen and Sen. Irene Treppler.

William Allen: Science Reporter

William Allen joined the *St.Louis Post-Dispatch* in January 1989 with the assignment to cover the science beat. He wasn't any more interested in earthquakes than anyone else. Before coming to St. Louis he knew only a little about the New Madrid Seismic Zone. As a science writer at the University of Illinois news bureau in the 1980s he was familiar with basic geologic concerns in the region.

To begin his job as a local science reporter in St. Louis, he sought out area scientists. From his initial conversations, one of the issues that came to the fore was that of the earthquake risk posed by the New Madrid Seismic Zone. As a result, he began covering educational meetings held by the Central U.S. Earthquake Consortium (CUSEC) in Memphis and the earthquake center at Southeast Missouri State University in Cape Girardeau, Missouri. The speakers discussed the earthquake hazard in the New Madrid area and how an earthquake could affect people and society. As he reported on these meetings, he realized that the region was vulnerable to a threat that scientists had been warning about for years. He realized that this was both a good "news" story and an important public service story. Fortunately, he had the full support of his editors to pursue this story, and in September 1989 the Post-Dispatch published a three-part series, “Earthquake: Ready or Not,” providing an overview of the earthquake threat and its potential consequences.

These articles, as well as Allen’s newfound expertise, were, in retrospect, perfectly timed one month before the Loma Prieta earthquake, which struck the San Francisco area on October 17, 1989. According to the Director of the State Emergency Management Agency at the time, these articles primed the public to support earthquake preparedness efforts. Three days after the earthquake, Allen and colleagues produced a special report, entitled “Earthquake: Is St. Louis Ready?” According to Allen, the issue in his articles that got the most attention was the vulnerability of St. Louis school buildings, which are largely constructed of unreinforced masonry. *Post-Dispatch* writers, including Allen, continued to follow seismic safety news over the ensuing months.

Irene Treppler: State Legislator

Irene Treppler, a Republican state senator from south St. Louis County was very much influenced by the *Post-Dispatch* articles. Sen. Treppler was born in St. Louis County and attended local public schools, so she was well aware of the traditional school construction style. Her realization that earthquake preparedness actions could prevent most of these casualties moved her to act.

At that time Missouri –similar to most other states in the central United States--lacked coordinated plans for responding to major earthquake disasters. Neither the public nor key professionals were very aware of how they could address the earthquake threat. There were no required building codes that would lessen the impact of a quake on large buildings and schools. Despite estimates that a quarter or more of the fatalities from a major daytime earthquake in the New Madrid fault zone would be school children, the state of Missouri neither required new schools to be built to withstand earthquakes nor required strengthening or surveys of older vulnerable schools.

In November 1989, Sen. Treppler initiated a proposal to require all Missouri school districts to have an earthquake emergency-procedure system for each school, and a second proposal to require that new school buildings and renovations be designed according to accepted seismic building codes to withstand damage from an earthquake. She found an ally in Larry Thomason, a Democrat from Kennett, which is in the most seismically active part of the state. They combined both proposals into one bill, and, in order to gain the support of the Missouri Municipal League, they deleted a requirement for local inspection and enforcement of seismic building codes.

Missouri's Geologic Hazard Preparedness Act (S.B. 539), was passed in May 1990, and became effective in October 1990. It requires each school district in the 47 most seismically hazardous counties to establish an earthquake emergency procedure system. This includes a school building disaster plan, an earthquake exercise to be held twice each year, protective measures, and a training program. The Act specifically requires the annual distribution to all students of materials prepared by FEMA and SEMA, addressing awareness, understanding, and specific safety measures. With regard to the issue of seismic design, each jurisdiction within these 47 counties must adopt an ordinance stating that all new buildings (all public and educational buildings, as well as all private structures larger than 10,000 square feet) must "comply with the standards for seismic design and construction" of the BOCA or UBC model building codes. This comprehensive earthquake preparedness bill was one of the most publicized and important pieces of legislation passed during the 1990 session of the legislature.

In 1991 Sen.Treppler sponsored a resolution that would allow cities, counties and school districts to sell bonds to finance the renovation of buildings to withstand earthquakes.

This constitutional amendment required approval by voters. Because of anti-tax sentiment, however, the measure was defeated at the polls.

Sen. Treppler's bill creating a seismic safety commission won passage during the 1993 session of the Missouri General Assembly. The commission is responsible for developing a comprehensive program to prepare the state for appropriate response in case of a major earthquake. According to Sen. Treppler’s web page, in 1993 she received the national Otto Nuttli Earthquake Hazard Mitigation Award for her relentless efforts towards seismic safety in the State of Missouri.

These bills were major steps toward seismic safety in Missouri. The increased awareness of seismic safety in Missouri brought other benefits as well. For example, the St. Louis county emergency preparedness office and Missouri emergency management agency increased their public outreach efforts. Local hospitals and utilities increased their preparedness improved seismic designs for new buildings.

Reasons for success

Clearly, the early 1990s represented a confluence of events that encouraged seismic safety in Missouri. Longstanding efforts by the U.S. Geological Survey and FEMA began to bear fruit. CUSEC had been initiated in 1985, and news reports of the 1985 Mexico City and 1988 Armenia earthquakes had gotten attention in the New Madrid region. The Missouri Emergency Management Agency and the Missouri Division of Geology and Land Survey were increasing their efforts regarding seismic safety issues. The 1989 Loma Prieta earthquake—as well as the ensuing “prediction” of a major New Madrid earthquake in December 1990 by self-styled expert Iben Browning—greatly contributed to the climate of earthquake awareness and concern.

Even so, William Allen and Irene Treppler played critical roles.

Allen’s articles caught the public's attention and made readers aware or reminded them of the earthquake threat to Missouri. His writing was authoritative (using respected sources), clearly written, engaging, and of obvious public interest (identifying the potential for injuries, death and financial loss). Furthermore, the articles appeared in the region's most authoritative news medium, the daily newspaper for the St. Louis region.

According to Allen, the key to his articles was the information he obtained over several months of listening to and interviewing scientists, earthquake preparedness officials and other experts on the issue. They provided "mentoring" by inviting Allen to earthquake preparedness meetings and other programs, showing him their field projects and labs, and generally taking the time to answer his questions. The issues are complex and multidisciplinary--science, engineering, economics, politics, law enforcement, sociology—and so it takes some effort for a journalist to attain an appropriate level of understanding. Thus, his articles required both an interested journalist and a community of seismic safety experts who were willing to actively teach him about their field.

Sen. Treppler's active role ensured the success of these bills. First, she appreciated that Allen had identified serious problems that could affect the lives of future Missouri residents. Second, she was able to identify actions that the state could feasibly take to address seismic safety. Third, she was persistent in her efforts, despite initial failures. Finally, as an experienced legislator (she was elected to the Senate in 1984, having previously served six terms in the Missouri House of Representatives), she knew how to build alliances with other legislators and how to respond to the concerns of interest groups whose support or opposition could be key to the bills' success. She also knew how to work with key officials from state agencies who could help with technical aspects of the bills.

Lessons for Advocates:

- Awareness building is an important first step.

- It is important both to find interested reporters and to actively work with them to understand the issues and possible solutions. Active involvement by seismic safety professionals can ensure both the accuracy and credibility of news reports.

- Judicious use of media can help the professional community to convey a clear message.

- Earthquakes provide windows of opportunity to advance seismic safety policy, because they gain the attention of both the public and policy makers.

- Because earthquakes are not the topmost priority, it is important to demonstrate how seismic safety addresses other community issues such as safety of school children, fiscal health of local government and long-term sustainability of the local economy. School safety is a particularly salient issue.

- Enactment of legislation requires committed and persistent legislators concerned about public safety and welfare.

- Experienced legislators know how a bill becomes law and how to build support among fellow legislators. But advocates can help by drafting appropriate language, providing technical advice, and gaining support from key groups.

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<u>Example Five</u>

Utah: School Retrofit, Seismic Safety Commission And More

Several dedicated advocates persevered over two decades beginning in the 1970s to gain support for seismic safety.

Seismic Hazard in Utah

According to the Utah Geological Survey, earthquakes can occur virtually anywhere in Utah, but especially in a north-south band that cuts a central swath through the state. In the northern part of Utah, the earthquake belt is roughly centered on the Wasatch fault where the Wasatch Mountains meet the desert. Since 1850, 16 earthquakes of magnitude 5.5 or greater have occurred in this seismic belt in Utah. The largest historic earthquake was a magnitude 6.6 event in Hansel Valley in 1934, which caused surface ruptures across the mudflats of Great Salt Lake. The most damaging earthquake was a 1962 magnitude 5.7 event in Richmond, that caused one million dollars (1962 dollars) in damage. The most recent damaging earthquake was a magnitude 5.8 event near St. George, that cost about $1 million in 1992 dollars, mostly from a large landslide 28 miles away in Springdale that destroyed three houses.

Utah's Wasatch fault presents the greatest earthquake hazard to the state's population because of its length and proximity to the majority of residents. More than 80% of Utah's population of two million is concentrated on or near the Wasatch fault. Over the past 6,000 years, at least 19 earthquakes large enough to rupture the ground surface have occurred on the Wasatch fault. Approximately every 350 years a large earthquake happens somewhere on the fault.

In short, geologists and seismologists know that Utah contains a region of significant earthquake hazard, and the greatest hazard is where most of the population lives. But the state’s most heavily urbanized region, from Provo to Ogden, has not experienced a serious local earthquake greater than magnitude 5.5 in historic time. The last disruptive local shock was a magnitude 5.2 earthquake in the western Salt Lake Valley in 1962.

The Action: $200 Million in School Seismic Retrofit Bonds

Despite the lack of an earthquake experience in most of the community’s memory—and no experience of a “Big One” in historic time—the citizens of Salt Lake City have taken two stunning actions over the past decade. In 1993, the Salt Lake City School Board of Education went to the voters and requested the passage of a $70 million bond to mitigate the condition of school buildings. The bond passed with an 81% voter approval. After it began, they decided to augment it with $50 million dollars on-going capital. The $120 million covered retrofitting two high schools, replacing the main building of one high school, replacing one high school, and mitigating non-structural life hazards in all school buildings.

The School Board then identified the need to retrofit all 27 elementary school buildings and the five middle school buildings. The total cost—including building two additional elementary schools, air conditioning all buildings, and building to seismic zone 4—was estimated at $278 million, and would require bond approval for $136 million. In May 1999 this bond issue passed with the support of 69% of the voters.

Overwhelming voter support for $200 million of debt--most of which was targeted at an earthquake that must seem very remote to the populace--demands some explanation. Part of the answer is that the School Board is highly respected and has a reputation for being fiscally responsible. Another part of the answer is that the School Board ran a very sophisticated election campaign, with the assistance of a respected polling company, and they also worked hard to gain the support of all school employees as well as every city community council and special interest group. But we think an important part of the answer lies elsewhere: in the climate of seismic safety awareness that has slowly grown over the past three decades in Utah in general and Salt Lake City in particular. And this climate is largely due to the persistent work of a small set of advocates over many years.

This climate of seismic safety awareness is further illustrated by a more recent undertaking: the $200 million renovation of the State Capitol complex in Salt Lake City. The major part of this project, which will be completed in 2008 (and also improves the heating and cooling systems), is a seismic base isolation system beneath the building.

Finally, the two generations of seismic safety commissions in Utah provide evidence of interest in seismic safety, and they also both have played important roles in contributing to that climate. The Utah Seismic Safety Advisory Council was

Utah Chronology (from Mittler, 1998)

1975	Pocatello Valley (magnitude 6.0) EQ
1976	USGS study estimated 63% chance that an earthquake exceeding or equaling magnitude 7.5 may occur in 100 years
1977	Legislature created the Utah Seismic Safety Advisory Council (USSAC), which reached its sunset date in four years (1981)
1981	FEMA funded the position of Earthquake Program Officer in DES
1982	NEHRP organized a meeting to discuss future direction of program
1983	Governor's Conference on Geological Hazards in Salt Lake City; EQ (magnitude 7.3) in Borah Peak, Idaho
1983	On NEHRP mandate, USGS initiates 3-year (extended to 5-year) program to study EQ s in Utah and to work of the implementation of EQ mitigation policies
1984	Enactment of Geologic Hazards Information Act
1989	Atwood and Arabasz present recommendations to Utah Advisory Council on Intergovernmental Relations (UACIR), legislation supported by UACIR but all failed; Loma Prieta EQ
1990	Sixth Annual Wasatch Front EQ Conference, which lead to the creation of the EQ Task Force
1991	The state, through executive action, created the Utah Earthquake Advisory Board, funded by FEMA as a one year grant to DES, prepared a draft of *Utah at Risk* that later quickened the process for the Bill/the creation of USSC
1994	Northridge EQ; Utah legislature enacted House Bill 358, establishing the Utah Seismic Safety Commission (USSC), sponsored by Rep. Ken Burningham

created by the state legislature in 1977, with a four-year sunset clause. In 1991, executive action created the Utah Earthquake Advisory Board. And the 1994 legislature created the Utah Seismic Safety Commission, which is still in existence. Both of these will be described in more detail within the following stories.

The Advocates

As with the other stories in this collection, advocates do not work alone. They work with allies and supporters, and their initial efforts owe much to the critical assistance provided by federal NEHRP agencies, such as the U.S. Geological Survey and FEMA. Even so, success requires the hard work of a few key individuals who can keep the idea alive, make it grow over the years, develop creative strategies, and take advantage of opportunities as they arise over time. We think some of the key advocates in Utah during the period we examine have been: Walter Arabasz, Genevieve Atwood, Lorayne Frank, and Lawrence Reaveley. There have been many others as well, and we apologize for not listing them all. Furthermore, they, in turn, not only depended on the work of individuals and agencies that preceded them, but also on important efforts by their staff and colleagues.

The U.S. Geological Survey (and key individuals within it) also played an important role in getting things started. In 1983, the USGS initiated the Utah Regional Earthquake Hazards Assessment Program, in conjunction with the Utah Geological Survey, as well as a variety of other governmental and university partners. This program had the conscious intent to both encourage research and to create interaction between researchers and users so as to increase the relevance and use of the research. Over a five-year period, the USGS held annual workshops. One particularly innovative part of this program was the funding, for three years, of placing geologists within the county planning staffs of five Wasatch Front counties. The October 1983 magnitude 7.3 earthquake at Borah Peak, Idaho, further helped to underscore the hazard in this part of the country.

Genevieve Atwood: Geologist, Legislator

Genevieve Atwood was always interested in geology, education, and public service. Fresh from receiving her degrees in history and geology, and after working two years for the National Academy of Sciences, she was elected to the Utah State House of Representatives in 1974 at the age of 28. She served for six years, while also working as a staff geologist at an engineering firm.

A key achievement of Atwood's time in the legislature was her sponsorship of the Seismic Safety Advisory Council Act in 1977. According to Olson and Olson's account, the act was successful for three reasons: sufficient funds were available that year, Atwood wrote in a four-year sunset clause for the Council, and many legislators personally liked her and respected her knowledge of earthquake issues. The scene was set for this bill by the previous existence of a Governor's Committee on Geologic Hazards, and by the precedent of the California Seismic Safety Commission, but it took Atwood—an articulate and credible advocate within the legislature—to make it happen.

Unfortunately, the Council was not successful in enacting legislation before its demise four years later; and Atwood was no longer in the legislature to promote it. Atwood now calls the 4-year sunset both a blessing and a curse. It was a blessing because the agency was independent, which increased its credibility and effectiveness. But it was a curse because it had no patron to protect it. The Council did, however, make an important start in creating a network of seismic safety advocates, providing a factual basis for future actions, and providing legitimacy for promotion of seismic safety as a public policy issue in Utah. It provided an important foundation that the USGS/UGS work would build on in the 1980s.

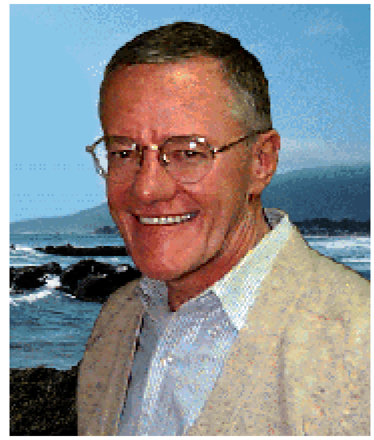
Genevieve Atwood, as it turns out, also played a key role in the efforts of the 1980s. From 1981 to 1989 she was the State Geologist and Director of the Utah Geological Survey. Thus, when the USGS came to Utah, seeking local partners, they found that the state geological agency was led by a young, energetic, policy-minded individual who was already steeped in seismic safety issues (as a result of the four years of the Council that she had created).

Atwood says she was always interested in "big issues" and was inspired by her work at the National Academy of Sciences and especially by the career of Gilbert White. Thus, from early on she was interested in the interface of science and policy. When a legislative seat came open, several people encouraged her to run. Once elected, she found herself instantly successful in the legislature, because colleagues respected her expertise. And they also trusted her personally. She took advantage of the opportunity to begin sponsoring appropriate legislation. The USGS and others concerned with geologic hazards quickly learned to come to her, because she was an inside advocate for their concerns. She believes that scientists can, and should, make a difference. And, pointing to her current position on the Board of Trustees of the Metropolitan Water District of Salt Lake, she says that one does not need to be a legislator or state geologist to use science to inform policy.

Atwood's current passion is earth science education. She creates courses and resource materials to improve the teaching of earth science. This is her way of helping to create a new generation of scientifically informed citizens.

Her advice for future advocates: a scientist who cares can be effective in many ways. Science and policy need each other, and anyone who takes the time to act can make a difference. Finally, she points out that, although one person can make a difference, organizations are also important. Since she left state government, many others have continued the work she began.

Walter Arabasz: Seismologist



Walter Arabasz is a research professor of geology and geophysics at the University of Utah, where he has worked as a seismologist since 1974 and has been director of the University's seismograph stations since 1985.

A December 2002 article in *Salt Lake Magazine* nicely summarizes his work:

> In 1996 he received the Governor's Medal for Science and Technology for his "tireless efforts to help residents and leaders understand and prepare for Utah's earthquake hazards." Tireless may be an understatement. Over the years Arabasz has fought to obtain funding to monitor and combat a threat many Utahns aren't even aware of, and which may not happen in their lifetime. He has been involved in the Utah Seismic Safety Commission since its inception in 1994, and served as Chair from 1997-2001. His dedication has paid off in ways that the general public will see only when the big quake hits the Wasatch Front.

Arabasz says that as a seismologist he gradually came to have a keen sense of responsibility to the needs of the public. As result, he became involved in policy making at both the state and national level. As the University's seismograph stations became more prominent in Utah, his involvement put him in the public view. The media frequently seeks him out as a spokesperson for seismic issues. He has used this visibility as an opportunity to inform the public of earthquake risks and what actions they can take. A 1997 article in the Salt Lake Tribune quotes a TV reporter saying that Arabasz has, with experience, developed the knack for "talking with analogies and homespun terms you could understand."

A major effort of Arabasz over the years has been to constantly work on improving seismic monitoring in Utah, including the recent successful creation of a real-time earthquake information system as part of an Advanced National Seismic System. This work is both of scientific and public importance, and it requires public policy skills to make a case for funding. The Salt Lake Tribune article describes him as being credible, savvy, calm, and determined. Rather than being an alarmist, he is a voice of reason, and this makes him effective in communicating to the public and in persuading policy makers.

Arabasz's and Atwood's stories of their initial interest in geology are remarkably similar. Neither one was aware of geology when starting college. Arabasz began as an English major, and Atwood received an undergraduate degree in history. But both were hooked when they took their first course in geology, and both have maintained that passion over the years, while successfully educating others about the significance of understanding the earth we live upon.

Arabasz attributes Utah's successes in seismic policy actions during the 1980s through the mid-1990s to the initial USGS efforts and to a partnership that was forged among Atwood, Frank, and himself as the respective heads of the Utah Geological Survey (UGS), Utah Division of Comprehensive Emergency Management (CEM), and the University of Utah Seismograph Stations (UUSS). The partnering of these three organizations continues to provide the underpinnings of Utah's state earthquake program, with key roles by Lee Allison and Gary Christenson of the UGS, Jim Tingey and Bob Carey of CEM, and Sue Nava of UUSS. Arabasz also credits the Northridge Earthquake with helping to spur the initiation of the Utah Seismic Safety Commission in 1994.

Arabasz has several words of advice for future advocates. First, they need to be patient. The process takes time, and advocates might even need an earthquake before action can occur. Second, advocates need to become knowledgeable about the political process, and then interact directly with legislators and the community. Personal contact with legislators is vital, whether at the state or federal levels. Third, successes will be small and incremental; it is always a work in progress.

Related Story: The Utah Seismic Safety Commission and a Legislative Advocate

In a paper on the Utah Seismic Safety Commission, Mittler (1998) describes the work of Arabasz and Atwood in the late 1980s, working with the legislature to obtain funding for the seismic network. Despite their lack of success, these efforts were important, because they cemented working relationships with key legislators, while also maintaining legislative awareness of seismic safety (and the 1989 Loma Prieta earthquake did not hurt, either).

At about the same time, because the USGS project has just ended, Arabasz, Atwood, and Frank were asked by the Utah Advisory Council on Intergovernmental Relations (UACIR) to prepare a prioritized list of recommendations. This resulted in six bills introduced by eight legislators in the 1990 session, but all failed. Undaunted, the UACIR established an Earthquake Task Force, whose top priority was establishing a Seismic Safety Commission. Again in 1991, all their recommended bills failed.

Arabasz, Frank, and Lee Allison (Atwood's successor at UGS) then devised an alternate strategy for the Commission. They created a Utah Earthquake Advisory Board in 1991 within the Utah Division of Emergency Services (DES). It was funded within an existing agency, with financial assistance from FEMA. The Board set out to establish a seismic safety strategy for Utah, and a subsequent legislative resolution officially recognized the body. The January 1994 Northridge Earthquake, however, changed things. Spurred on by this event, Rep. Ken Burningham proposed an independent Seismic Safety Commission, supported through the budgets of existing agencies. The bill was passed, signed by the Governor, and the commission was authorized in July 1994. Les Youd, a highly-respected geotechnical engineer from Brigham Young University, became the commission's first chair and served in that role from 1994 to 1997.

According to Mittler, Rep. Burningham was key to passage of this bill. He championed it and worked relentlessly to enact it. He had been a school teacher, and his motivation was school safety. His involvement in the failed earthquake bills of previous years meant that he had the knowledge and the contacts to quickly draft a bill that would meet with the approval of the legislature and the agencies. It succeeded because legislators were already aware of seismic safety, the Northridge earthquake created heightened concerns, and the bill was fiscally neutral.

The creation of a Seismic Safety Commission is, of course, only a first step. And, in an environment in which the legislature has a record of rejecting any new programs that cost money, it is not likely that the Commission could create any bold new initiatives at the state level. As a result, the Commission has focused more on community outreach and encouragement of voluntary activities. As with all other state seismic safety advisory bodies, even with no specific action programs, its role is vital as a continuing conscience for seismic safety within state government.

Lorayne Frank: Emergency Manager

Lorayne Frank retired from her position as Director of the Division of Comprehensive Emergency Management in 1998, after more than 34 years of state service. All the other advocates have described the key role she played. Although we were unable to contact her, we obtained a tribute written in 1998 by the DCEM Earthquake Program Manager, and we could also see in Mittler's account the key role that Frank played over the years in seismic safety policy.

Frank was the Director of CEM for over 18 years, having begun in Utah state government in the Planning Coordinator's Office. Among the many organizations she was involved in, she was Chair of the Utah Earthquake Advisory Board and the Western States Seismic Policy Council. Her commitment to seismic safety and the continuity she provided through the 1980s and 1990s were important in maintaining seismic safety as an issue in Utah.

Seismic safety is a difficult policy issue because of the infrequency of earthquakes. This is particularly true in a state with no significant damaging earthquakes in modern times. It would be easy for the director of Utah's emergency management agency to focus entirely on the more immediate issues of fires and flooding. Clearly, this is not what happened in Utah, as Frank aggressively pursued seismic safety efforts. Conversely, seismic safety as an issue would not get very far in a state whose emergency management director did not support it.

Although we could not speak to Frank to obtain her advice for advocates, her example makes clear one piece of advice: if you can gain the enthusiastic support of your emergency management director, it will be much easier for you to succeed.

Lawrence Reaveley: Structural Engineer

Reaveley is a structural engineer. He is the chair of the Department of Civil and Environmental Engineering at the University of Utah, and is the current (2003) president of the Structural Engineers Association of Utah. He originally specialized in blast dynamics, but in the mid 1970s he learned about seismic design when working on a new University of Utah hospital, along with Degenkolb Associates from California. Because this was intended to be the hospital of last resort for the region, it was important that it be able to withstand earthquakes, and so they designed it to exceed minimum code levels. According to Reaveley, the most important event in helping him and others promote seismic safety was geologist Lloyd Cluff's trenching of the Wasatch Fault in the early 1970s. This was critical, because this work showed that the fault was active. It showed that the fault has repeatedly generated large earthquakes over the years; it showed that the new seismic building codes following the 1971 San Fernando earthquake were also relevant for Utah.[4] As a result of the fault studies and of the precedent set by the hospital, interest began to grow in the area. Reaveley and others then "made it a quest" to improve seismic construction standards in the area.

One significant action was to increase the building code seismic design provisions. According to Reaveley, based on accepted California standards, the hazard posed by the Wasatch Fault is clearly equivalent to UBC zone 4. The code battle took many years, culminating in adoption of higher provisions in the IBC 2000 code.

Reaveley also credits the Salt Lake City Board of Education. Several of the elected members were very concerned about seismic safety issues, and some were design professionals. In the 1980s, for example, they designated a citizen advisory board to examine the seismic safety of schools, and he worked for them in developing a survey of school buildings.

Reaveley is proud of what they have all accomplished over the years. They have replaced all the hospitals over 25 years, as well as a lot of fire stations, city and county buildings, and school buildings. In some cases, they teamed up with the fire marshal to make their case. In some cases, they used nearby earthquakes—such as the 1983 Borah Peak earthquake, or the 1992 St. George earthquake—to illustrate the risk posed by unreinforced masonry buildings.

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[4] Why did Cluff decide to trench along the Wasatch fault? According to Cluff, he had long been interested in investigating this fault while a student at the University of Utah. While working on the Hayward Fault in the San Francisco Bay area, his interest increased. He was able to convince the USGS to fund the work, through the Utah Geological Survey. The work, including air photo analysis, extended over several years. It was completed in the mid-1970s and was published in the *Bulletin of the Seismological Society of America* in 1980.

Lessons for Advocates

Utah's experience provides a variety of lessons. This abbreviated account of a very complex history only illustrates some of them:

- Individuals can make a difference.

- Scientists have the power of information, and it works. If credible scientists speak out, people will listen.

- Individual qualities are important for advocates. Some of the qualities we see in Utah's advocates are expertise, knowledge, and trustworthiness.

- For young advocates: enthusiasm can take you far. When Atwood ran for the legislature, she probably didn't realize that she was too young to accomplish what she did.

- Collaborate and "network." Collaboration and active networking can expand resources (funding, expertise), cultivate new ideas, encourage a comprehensive approach, and broaden the base of involved advocates.

- Be persistent, and understand that the process will be long.

- Become familiar with the political process and become directly involved, interacting with legislators and community members.

- Federal agencies and their funding can be critical catalysts for action.

- A lesson for federal agencies: the USGS set out to build local awareness and capacity for effective future action, and it worked. The interactive workshops between academics and professionals were crucial elements.

- Public education establishes an important foundation. Instill awareness in children and they will become adults familiar with the issues.

- Tie in seismic safety with issues of greater public interest. In Utah, concerns about school safety have been at the center of the most dramatic accomplishments in seismic safety.

- Make information easy to understand and use the media.

- Take advantage of windows of opportunity. The Borah Peak, Loma Prieta, and Northridge earthquakes all helped to increase awareness and facilitate actions.

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Example Six

Seattle, Washington: School Safety

A determined citizen advocate and a dedicated professional improved the seismic safety of Seattle's schools and increased community awareness of the earthquake threat.

Seismic Hazard in Seattle

Seattle is in a highly seismically active part of the country, adjacent to volcanoes and situated within three earthquake source zones that together yield more than one thousand earthquakes each year. Despite not having any disastrous earthquakes in historic time, Seattle has been affected by numerous damaging quakes, and recent research confirms that great earthquakes have struck the Seattle area in the past.

According to the U.S. Geological Survey website on earthquake hazards in the Pacific Northwest, western Washington can be affected by three types of earthquake sources: deep earthquakes beneath Puget Sound, shallow faults that can severely affect localized areas, and subduction zone earthquakes that can cause strong shaking across the entire region. The largest earthquakes in historic time have been deep earthquakes of M 7.1 in 1949, M 6.5 in 1965, and M 6.8 in February 2001. Fifteen deaths were attributed to the 1949 and 1965 quakes. Research in the early 1990s concluded that great subduction zone earthquakes, of magnitude 8 to 9, repeatedly occur. The most recent one was on January 26, 1700. It lowered portions of the coastline, and also caused a tsunami in Japan (which is how researchers determined the exact date). In addition, geologists have found evidence of a large (M 7+) earthquake 1100 years ago on the Seattle fault—which runs east-west right through Seattle—and this fault may also have caused other more recent earthquakes.

According to the City of Seattle's Project Impact website, "The magnitude 7.1 1949 earthquake damaged 21 schools in the Seattle School District, resulting in the temporary closure of five schools and the condemnation of three. The magnitude 6.5 1965 earthquake resulted in the closure of eight schools, including two in West Seattle that were extensively damaged. Most damage occurred to older unreinforced masonry (brick) buildings with inferior mortar." In fact, both of these earthquakes caused disproportionate damage to school buildings throughout the region. Thirty Washington schools, normally housing 10,000 students, were damaged in 1949. Two students were killed in the 1949 earthquake—at the high school in Castle Rock and at Lowell Elementary School in Tacoma. Both students were killed by bricks falling onto exitways from the exterior of the buildings. Closure of Seattle schools for spring vacation averted fatalities and severe injuries to school children from similar building damage.

The Action: Improvement of Unsafe Schools

The Seattle School District carried out a number of facility and seismic evaluations over a thirty-year period from the mid-1960s to the mid-1990s. Four noteworthy studies that incorporate seismic evaluations as a significant element include: (1) a broad 1975

Facilities Utilitization Study, (2) a 1983 *Comprehensive Survey of Educational Facilities*, (3) a 1989 *Historic Building Survey*, and (4) a 1991 report, *Structural Evaluation of Seattle Public Schools*.

The 1975 *Facilities Utilization Study* evaluated school facility needs through the year 2000. This study was triggered by concerns for seismic safety, the need to close schools due to declining enrollments, and the need to provide racial equity in the city's schools. One recommendation of the study was that the District adopt a long-range plan to upgrade all unreinforced masonry (URM) school buildings. In 1977 the Seattle School District hired a number of structural engineering firms to assess the seismic safety of district school buildings. In particular, they were concerned that URM school buildings would share deficiencies identified in a 1976 inspection requested by the principal of a URM elementary school. This led to a study of 22 URM schools (out of 97 district schools). The report, "Seismic Survey of 22 Seattle Schools," issued in November 1977 and presented to the School Board in January 1978, concluded that there were "grave risks" that even minor earthquakes or strong winds could bring material down on people or cause collapse of these buildings. The district immediately addressed hazards in 19 of the 22 schools to remove them from the "grave risk" category. Of the remaining three schools, two were closed, only in part due to seismic hazards, and one was determined not to need immediate remediation. In 1979, 10 additional schools and 53 chimneys were evaluated based on concerns raised by the 1977 survey. Upgrades to 10 of these schools and 41 masonry chimneys were completed by October 1979.

The 1983 *Comprehensive Survey of Educational Facilities* used teams of engineers to evaluate building systems in 163 school buildings located at 101 separate sites. The study gave special attention to seismic evaluation and estimated the costs to bring buildings into compliance with the Uniform Building Code. Capital Improvement Program 1 (CIP1) in 1983 funded the remodeling or replacement of 16 older schools. The *Facilities Master Plan* (Capital Improvement Program 2), completed in 1990-1991, identified facility upgrades still needed following CIP1. The CIP2 program, funded by the passage of local bond issues in 1995 and 2001 covered the retrofit or replacement of an additional 19 school buildings. Although this completed the 30-year program to mitigate URM and other school buildings, the district is still working to address concerns regarding additional buildings.

Nonstructural hazards, however, have remained as a continuing problem in school buildings. In 1988, a grant from FEMA supported preparation of a nonstructural earthquake safety guide for all schools in Washington. The facilities department of the Washington Office of the Superintendent of Public Instruction (OSPI) distributed a copy to all state facility directors. Workshops on school nonstructural earthquake hazard mitigation were held for the Washington Association of Maintenance and Operations Adminstrators (WAMOA) and for Seattle School District maintenance personnel. In January 1998, Seattle was selected by FEMA as one of seven pilot Project Impact communities nationwide. The City received $1 million, and allocated it to three programs: hazard mapping, home retrofit, and school retrofit. The inclusion of school retrofit resulted from the substantial awareness and work already directed at school seismic safety. Seattle used the funding to update the state's non-structural hazard guide, remove overhead hazards, and train maintenance workers to identify and reduce nonstructural hazards. The updated non-structural guide is now included with the school facilities manual on the facilities webpage of the State Office of the Superintendent of Public Instruction. As of early 2003, the program had removed overhead hazards in 46 schools, retrofitted nine schools, and trained maintenance staff to inspect for hazards. According to the director of Seattle Emergency Management, retrofit saved lives in at least one third-grade classroom during the 2001 earthquake.

The Citizen Advocate

Carole Martens was concerned when she read the 1977 structural report of the Seattle schools. Her youngest child was going to attend one of the 22 URM schools. Active in PTA and school district issues since 1970, she began researching the topic, and a new career was born. She presented her findings before the school board and met with district administrators. Martens understood the strength of a united voice through large membership organizations such at PTA, the teachers unions, and other school-related groups. She persistently presented the issue of seismic safety and the inadequacy of URM school buildings before these groups, and she coordinated an effort that led the statewide PTA legislative assembly to adopt school seismic safety as a lobbying priority at the state legislature for three successive years.

As a result of this experience, Martens became an advocate for safety of the children in the public schools. As she puts it, the adult population makes the decisions, but a vulnerable population is at risk, so we need to be their voice. She became extremely knowledgeable on the topic, through her contacts with the city and school district, and through careful research at the University of Washington and U.S. Geological Survey. She says that she was always careful to obtain original source documents, so that she could be as accurate as possible in understanding and describing the risks.

In retrospect, it looks easy. The 22 schools are no longer a hazard, and many other seismic safety improvements have been made throughout the region. At the time, however, Martens and others had to work hard to explore every possible strategy toward achieving their goals. Martens became active in the PTA. She was appointed to the City of Seattle's Building Code Advisory Board. She then went to the state legislature, in Olympia (60 miles south of Seattle), and became registered as a citizen lobbyist. She was instrumental in writing a 1981 bill that would have required URM schools to be upgraded or converted to non-school use (it died in the Senate because of the costs involved). She was also instrumental in seismic safety bills in 1983, 1985, and 1986. The 1985 bill, to establish a state seismic safety commission, passed both houses of the legislature, but was vetoed by the governor. Although the governor vetoed the creation of a new commission in the governor's office, he supported its goals and helped to create a seismic safety advisory committee within the Department of Emergency Management.

In the City of Seattle, Martens was involved in many local school bond campaigns, and she took an active role in the successful 1983 CIP 1 campaign to fund school building improvements. She recalls that one of their efforts was to distribute a flier with a picture of each school and identification of its seismic safety condition.

The seeds that Martens planted during her time working with the legislature have continued to pay off over the years. Many of the legislators and staff she worked with have since gone on to more prominent positions within the state, and they have carried their awareness of earthquakes with them. For example, in writing the seismic safety commission bill she worked with Ron Sims--at that time a legislative aide, but now the King County Executive. In Sims' current post he has promoted emergency management activities, including King County's Project Impact program and seismic retrofitting of the Harborview Medical Center, King County Medical Examiner's Office, and King County Courthouse. In 2001, he went to Washington DC to receive the Building Disaster Resistant Communities Leadership Award from the National Associations of Counties (NACo) and the Federal Emergency Management Agency.

The skills and knowledge that Martens gained led eventually to a career in seismic safety work. In 1984, she prepared a report for the Seattle Public Schools Department of Facilities Planning, entitled *Earthquake Safety of School Buildings: A Discussion of the Minimum Seismic Safety Standards for the Seattle School District*. She also prepared a 1983 report, at the request of the Superintendent, identifying alternative uses for the 22 schools. Over the years, Martens has been invited to write numerous articles on seismic safety for a variety of publications, such as "Northwest Physician" and "On Site" (an apartment owners' association newspaper). She also wrote a guest editorial in the Seattle Times in support of the February 1995 bond issue. In 1988, Martens decided that she could be more effective within state government than as an outside advocate. She was hired by the Washington Department of Emergency Management to carry out the FEMA-funded seismic safety work plan for the state. In 1990 she left state government and became a consultant in earthquake preparedness planning for schools. For nearly a decade she worked with over 50 school districts, individual private and public schools, and daycare centers. By 1998, after over 20 years of working for school earthquake safety, Martens decided it was time for other activities.

Martens is particularly proud of the thoroughness of her research and the quality of the information she provided to decision makers. She stresses that the information one provides to a legislator must be accurate, honest, and fair.

The Dedicated Professional

As Martens (and all the other advocates in our study) points out, successful advocacy depends on teamwork. Martens identifies numerous key individuals in Seattle's and Washington's seismic safety efforts, including several highly dedicated state legislators and legislative aides (Dorothy Roberts, Larry Davis, Ron Sims, Monica Wootten, Kathy Reineke), and advisors such as Peter May of the University of Washington and Patricia Bolton of the Battelle Human Affairs Research Center in Seattle. A particularly valuable person—in the school safety work, as well as many other Washington seismic safety initiatives over the years—has been Linda Noson.

For 11 years Linda Noson was a seismologist at the University of Washington. One of her duties in this public position was to provide earthquake hazard information to public agencies, the legislature, and private organizations. As she puts it, “It seemed inadequate to only address the nature of the hazard without providing some suggestions for lowering one’s risk.” As a result, she developed a network of seismic safety professionals and was able to connect people with others who could help them. Eventually, she became a multidisciplinary seismic safety professional herself. Since leaving the University, she has worked with engineering firms, FEMA, and on her own, preparing numerous seismic safety studies for all levels of government. Noson is the prime author of the school nonstructural hazard guide cited above (both the 1989 and 2000 editions). She also was a leader in both the school and home retrofit programs for Seattle Project Impact.

Noson is proud of her work as a “directory”—in connecting people with each other—and as one who plants seeds of earthquake preparedness in many organizations. Rather than simply deliver publications or programs to agencies, Noson sees her goal as one of institutionalizing programs and developing self-sufficiency. For example, the school nonstructural program was purposely tied to existing programs in maintenance and facility planning, and the 1988 manual was designed to be consistent with the format of the State Facilities Safer Schools manual. The initial contacts developed for the 1988 edition of the manual were what made the Project Impact funding and the 2000 edition of the manual possible. The school program’s sustainability in the long term depends on its being integrated with other existing activities. For example, as part of Project Impact, the district’s logistics department has helped institutionalize a nonstructural mitigation program that involves district staff and parent and student volunteers.

Development of the home retrofit program involved creating partnerships with many members of the residential construction community. These included the Seattle Department of Design, Construction and Land Use (the institutional home of the program), representatives of the Washington Association of Building Officials, two other local building departments, the International Conference of Building Officials, a retrofit contractor, a structural engineer, a FEMA representative, and a Bank of America home loan officer. The program now includes prescriptive instructions for retrofitting a single family residence and training programs for contractors, building officials, and homeowners. Noson credits the success of the program to all the enthusiastic professionals and volunteers involved in it, but she helped to ensure its success by making sure that it involved a wide range of participants so that everyone sees the final products as their own.

In both the school and home retrofit programs, Noson made sure to involve organizations that reach beyond Seattle. This would help to facilitate the spread of the programs over time. In fact, many school districts have asked the Seattle school district for assistance in establishing similar programs, and the home retrofit program is now a regional program, serving 19 local jurisdictions in Washington.

Noson continues to be involved in coalition building efforts in the region. She has been one of several key members of the Cascadia Region Earthquake Workgroup (CREW), a nonprofit organization of public and private partners seeking to promote seismic safety throughout the Pacific Northwest. This organization, through local forums and conferences, has catalyzed new partnerships and specific projects to reduce seismic risks in the region.

As good coalition builders, Noson and Martens have crossed paths and worked together many times in the past. They met in the late 1970s when Martens first sought seismic information from the University of Washington. Noson, with two children in the Seattle School District at the time, was interested in supporting Martens' efforts. A few years later when Noson received funding to pilot test an earthquake education project, she hired Martens to help. They also worked together in developing the seismic safety commission legislation, as well as other projects.

As is true in all the other stories in this collection, many people play important roles in furthering seismic safety in the region. I would be remiss in not recognizing the efforts of Craig Weaver and Brian Atwater of the U.S. Geological Survey, Chris Jonientz-Trisler of FEMA, Jim Mullen of Seattle Emergency Management, Ed Heller and Teresa Salmon of the Seattle Public Schools, several structural engineers (e.g. Todd Perbix and Ben Emam), Roger Farris of the Phinney Neighborhood Association, and many other dedicated professionals in the Seattle area. Martens and Noson, however, stand out as long-term advocates, who, often on their own time, have taken extra efforts to advance the cause of seismic safety.

Lessons for Advocates

- Perseverance is important. Contact as many different people as possible, and be patient. As Martens says, "If five people say no, maybe the sixth will say yes."
- If you cannot make progress in one venue, consider switching to another. In the early 1980s, Martens was able to achieve some successes in Seattle that she could not achieve at the state level.
- Awareness building takes time, but it will eventually pay off. It is important to persistently keep the issue on the public agenda. In the case of the Seattle area, groundwork laid in the 1980s has resulted in broad coalitions of seismic safety interest in the current decade. Furthermore, initial efforts can attract funding and lead to expanded future efforts, as exemplified by the school nonstructural program.
- Partnerships and networks are critical to success. The more active participants, the better. They bring important perspectives to the effort, broaden the ownership of the activities, and make success more likely. Take advantage of existing networks.
- Advocates can initiate actions, but institutions sustain them. Seek appropriate partners with adequate institutional capacities to keep efforts going. Noson and others took this approach with the school and home retrofit programs in order to ensure their success and long term sustainability.

- Integrate seismic safety with existing programs. Look for opportunities to use existing programs and local leaders. According to Noson, those with existing responsibilities, such as school and hospital personnel, are most likely to have an interest in mitigation and preparedness actions.

- If you seek to influence state legislation, it is important to establish relationships with legislators and their staff. You can help them by drafting the legislation; they depend on knowledgeable people to draft legislation in areas they support. Martens reports that several supportive legislators went out of their way to provide her with assistance and even with working space. They, in turn, learned to trust her and the information she provided. Personal relationships are important.

- Seismic safety is accomplished in many ways: school district budgeting, local elections, state legislation, volunteer efforts, federal grants, implementation of local programs, building codes, and others.

- When earthquakes are not the topmost priority, demonstrate how it addresses other community issues. Public concern with school safety is an excellent place to begin creating interest in seismic safety in a community.

- The Seattle experience in the late 1970s and early 1980s shows that one can advance seismic safety even without having a big earthquake. On the other hand, it was the school experiences in the 1949 and 1965 earthquakes—coupled with increased nationwide seismic safety efforts following the 1971 San Fernando earthquake--that eventually led to the school retrofit program. And the 2001 earthquake helped to boost current efforts in Seattle.

- Although partnerships are important, dedicated individuals can make a difference.

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Example Seven

Building Rehabilitation And Seismic Code Laws In Oregon

Sustained long term efforts by Oregon Seismic Safety Policy Advisory Council, staff of the state geologic agency, and a supportive legislator lead to successful passage of two ballot measures.

Seismic Hazard in Oregon

According to the Oregon Department of Geology and Mineral Industries (DOGAMI), earthquakes from three different sources threaten communities in Oregon: crustal, subduction zone and intraplate. Oregon's location at the boundary between two great tectonic plates creates a variety of types of seismic hazards (as well as tsunami and volcanic hazards). The most common are crustal earthquakes, which are shallow earthquakes within the earth's crust. The two largest earthquakes in recent years in Oregon, the Scotts Mills (magnitude 5.6), and Klamath Falls (magnitude 5.9 and magnitude 6.0) earthquakes of 1993 were crustal earthquakes. Oregon can also be affected by great subduction zone earthquakes, where the Pacific Ocean tectonic plate dips beneath the continental plate. Some of the most powerful earthquakes ever recorded occur in such zones around the world, such as the1960 Chilean and the 1964 Great Alaska earthquakes. Recent studies suggest that such events occur about once every 600 years on average in the Pacific Northwest; the last one was in 1700. Deeper intraplate earthquakes occur within the remains of the ocean floor being subducted beneath North America.

DOGAMI estimates losses from a magnitude 8.5 subduction zone earthquake would destroy over 30,000 buildings, and cause at least 8,000 casualties and $12 billion in economic damage. Alternatively, shaking levels expected to occur once every 500 years in Oregon, would destroy over 80,000 buildings, and cause over 25,000 casualties and $31 billion in economic damage.

As with most of the other states highlighted in our study, Oregon has not had a serious earthquake in modern times. Two of the largest earthquakes in recent memory both occurred in 1993: the magnitude 5.6 Scotts Mills earthquake caused $30 million in damage and the magnitude 5.9 and 6.0 Klamath Falls earthquakes caused $10 million in damage.

The Action: State Ballot Measures for Seismic Rehabilitation of Buildings

The November 5, 2002 Oregon General Election ballot contained two measures regarding seismic rehabilitation of public buildings. Measure 15 was to allow the state to issue general obligation bonds for seismic rehabilitation of public education buildings. "Public education buildings" includes state universities, community colleges, and local public schools. The bonds could fund both evaluation of the need for rehabilitation as well as the rehabilitation itself. The measure was written to amend the state constitution, which forbids the legislature from loaning the state's credit in excess of $50,000. Measure 15 identified a variety of sources of repayment, and it limited the total amount of debt to one-fifth of one percent of the real market value of all property in the state. Measure 16 was identical to Measure 15, except that it applied to emergency service buildings—primarily fire stations, police stations, and hospitals.

Both measures enjoyed strong support from a variety of interest groups. Measure 15 included a statement of support from the presidents of seven major universities as well as the chancellor of the Oregon University System. It also included statements by representatives of the Structural Engineers Association of Oregon, Oregon State Building and Construction Trades Council, American Council of Engineering Companies of Oregon, and Associated General Contractors Oregon-Columbia Chapter. Similarly, Measure 16 included statements of support from the Oregon State Fire Fighters Council, Oregon Fire Chiefs' Association, Oregon Fire District Directors Association, and the Oregon Association of Hospitals and Health Systems.

Both measures passed, with nearly 56% of 1.2 million voters supporting each measure. Seventeen of Oregon's 36 counties had majorities in support of Measure 15. The counties that supported it tended to be the larger urban areas; in the two largest counties, Multnomah and Washington, over 63% of voters supported the measure. Support for Measure 16 was virtually the same as for Measure 15.

Both measures built directly off of previous legislative efforts. In 2001, the Oregon legislature passed and the Governor signed the following three bills (summarized from bill texts provided on the Oregon legislature's website):

> **SB 13** requires state and local agencies and employers with 250 or more full time employees to conduct earthquake drills. The administrative rules went into effect in April 2002. The drills are to consist of "drop, cover, and hold" and evacuation actions. (passed Senate 29-1 and House 36-8).
>
> **SB 14** directs the State Board of Education and State Board of Higher Education to provide for seismic safety surveys (using FEMA's rapid visual screening method, FEMA-154) of buildings with a capacity of at least 250 people that are routinely used for student activities. Second, it provides for further evaluation of buildings, as appropriate, using FEMA-310. Third, it directs the appropriate educational board to develop a plan for seismic rehabilitation for any buildings found "to pose an undue risk to life safety during a seismic event." It further specifies that boards should rank the relative benefit of such projects "in comparison with other life safety and code requirement projects." Finally, it requires completion of all these actions by January 1, 2032, "subject to availability of funding."
>
> The latter point is key. No funding was provided in SB 14. The initial surveys were conditioned on "the provision of funding by the State Department of Geology and Mineral Industries from gifts, grants, and donations made available" for carrying them out, and the more detailed surveys and rehabilitation work was conditioned "only if the Legislative Assembly provides the funding pursuant to a

grant of bonding authority approved by the people at the first general election held throughout the state on or after January 1, 2002." The act appropriated a placeholder amount of $1 to the Department of Geology and Mineral Industries to carry out the act. (passed Senate 23-4 and House 45-1).

SB 15 was similar to SB 14, except that it applied to hospital buildings, fire stations, and law enforcement facilities. (passed Senate 23-5 and House 46-12).

Senate Joint Resolution 21 proposed a constitutional amendment to allow for the issuance of bonds to pay for seismic rehabilitation of educational buildings, subject to voter approval at the next general election. This was a necessary step toward being able to fund SB 14. This resolution was the language that was later approved by the voters as Measure 15.

Senate Joint Resolution 22 proposed a constitutional amendment to allow for the issuance of bonds to pay for seismic rehabilitation of hospitals, law enforcement, and fire facilties, subject to voter approval at the next general election. This was a necessary step toward being able to fund SB 15. This resolution was the language that was later approved by the voters as Measure 16.

Thus, Measures 15 and 16 were the direct result of two pairs of legislative actions the previous year—one establishing the approach to accomplishing seismic rehabilitation of critical facilities, and the second providing a funding mechanism, subject to voter approval.

The next step will be to implement these measures. Both measures enable the issuance of bonds, but neither one requires any action. The state will still need to establish priorities regarding issuance of bonds and allocation of funds throughout the state. Furthermore, the state must first pay for the necessary surveys. So it may still be some time before seismic rehabilitation actually occurs.

Even though the job is far from complete, legislative and voter approval of these measures is a major accomplishment. First, the legislature has made a significant step by officially recognizing that a seismic risk exists in Oregon and that critical facilities deserve priority attention. Second, SB 14 and SB 15 lay out a logical approach toward implementing seismic rehabilitation, including initial surveys, evaluation, and priority setting. Third, and most significantly, the state's voters are now on record as recognizing the seismic risk to critical facilities and authorizing the state to issue bonds to improve the seismic safety of those facilities.

How did this remarkable set of events in 2001 and 2002 come to be? It represents the culmination of many years of work by a number of dedicated people, focused primarily around the Oregon Seismic Safety Policy Advisory Council (OSSPAC) and the Department of Geology and Mineral Industries. Although many individuals played key roles—such as Chris Thompson (a structural engineer member of OSSPAC) and Mark Darienzo of Oregon Emergency Management—two people stand out for their work in bringing these legislative acts and ballot measures to completion: Yumei Wang, who was instrumental in both OSSPAC and DOGAMI, and Senator Peter Courtney, who sponsored and promoted the bills. The following account describes the important work of these organizations, and then focuses on the roles played by Wang and Courtney.

Legislative Incubator: Oregon Seismic Safety Policy Advisory Council

The 1989 Loma Prieta Earthquake in Northern California increased concerns about seismic safety in Oregon. Furthermore, during the late 1980s and early 1990s, work by Brian Atwater and others at the U.S. Geological Survey had uncovered evidence of large earthquakes along the coast of Washington and Oregon (see Rogers and others, 1996). As a result, in 1991, Senate Bill 96 created the Oregon Seismic Safety Policy Advisory Commission (OSSPAC), with the mission of reducing exposure to earthquake hazards "through planning, public information, research, mitigation of hazard, and preparation for response and recovery."[5] It consists of 18 members, half representing relevant state agencies and half representing a variety of stakeholder groups, including the legislature, local government, utilities, and the building industry. The legislation specifically charges OSSPAC with advising the Governor and legislature and with preparing legislative proposals. The legislation further states that OSSPAC is to use existing agencies to achieve its goals, with support services provided primarily by the Office of Emergency Management. "Emphasis shall be on coordination and linking of existing resources and authorities." Over the years, DOGAMI has proven to be a key resource in supporting the work of OSSPAC.

Over the past decade, OSSPAC has provided a forum for policy review and for sharing of information among stakeholders. Local and state agencies have pursued a number of seismic safety efforts during this time period (described below), and OSSPAC has provided a mechanism for sharing stakeholder knowledge and perspectives while attempting to develop viable policy directions for the future.

Seismic Safety Activities in Oregon: New Buildings, Existing Buildings, Loss Estimates

Oregon has seen a variety of seismic safety efforts throughout the 1990s, at the state and local levels. This has included strengthening of highway bridges, local school buildings, and selected public and private buildings. The Scotts Mills earthquake of 1993 damaged the State Capitol building in Salem, requiring legislators to meet elsewhere while the building was repaired. This event, reinforced by the 1993 earthquake in Klamath Falls, ensured that seismic safety remained on the minds of legislators. In particular, two areas of emphasis have been: improving building codes for new buildings and developing strategies for improving the safety of existing buildings.

The State of Oregon had no statewide building code until 1974, when it adopted the Uniform Building Code (UBC), with the entire state in seismic zone 2 (this account comes primarily from Miller, 2003, and from the Seismic Rehabilitation Task Force,

[5] The same bill also required schools to hold earthquake safety drills.

1996). In 1990, the State adopted the 1988 UBC, which changed the state's seismic zone from 2 to 2b. Over the following decade Oregon dramatically increased seismic code requirements for new buildings. In 1993, the State adopted the new 1991 UBC, which had Zone 2b east of the Cascade mountains, and Zone 3 to the west. This put Portland in Zone 3, which increased seismic design loads by 50 percent over the previous code. In 1998, the State adopted the 1997 UBC with an increase to Zone 4—the same high hazard designation used in coastal California—on the southern Oregon coast. The structural engineering committee of the Oregon State Building Codes Division held public meetings in 12 communities along the south coast prior to making this change, and found that stakeholders in these communities were firmly in support of the new zone. Soon, under the new International Building Code, the north coast will effectively be under Zone 4 as well. Thus, in 30 years, Oregon has gone from having no seismic building code to having substantial parts of the state subject to the most stringent seismic requirements for new buildings.

In 1993, the City of Portland established a Task Force on Seismic Strengthening of Existing Buildings (this account comes primarily from the Seismic Rehabilitation Task Force, 1996). Following their recommendations, the state legislature in 1995 passed SB 1057[6], which established a state Seismic Rehabilitation Task Force, with the charge of making recommendations to the legislature by September 30, 1996. The 15-member task force, led by Chair Paul Lorenzini completed an impressive task. Over a 9-month period, they held 27 meetings in Salem and Portland, plus town hall meetings in Klamath Falls, Eugene, and Newport. They reviewed an extensive list of documents, listened to 14 invited presentations, and received comments from over 70 individuals and organizations. The product was a report that carefully laid out a systematic program that defines priority buildings (according to structure type and building use) and establishes specific, feasible timelines for implementing them. It includes cost estimates and proposes specific incentives to achieve the goals of the program. Based on these recommendations, DOGAMI introduced HB 2139 in the 1997 legislature on behalf of the Task Force, but the bill did not pass. The following year, OSSPAC held hearings to try to determine new legislative priorities for seismic safety.

In 1998, DOGAMI conducted the first statewide earthquake loss estimation study in the nation, using FEMA's HAZUS software. This resulted in a summary publication for wide public use (Wang and Clark, 1999). Some parts of the state also performed more detailed local studies. For example, Portland State University conducted a loss estimate for Portland Metro, and it included an inventory of 50,000 buildings. The Oregon Institute of Technology conducted an ATC-21 survey of 1,000 buildings in Klamath County, and DOGAMI performed a HAZUS analysis. The DOGAMI statewide HAZUS study gained considerable attention throughout Oregon, and led to a number of actions by state and local agencies (Wang, Hasenberg, and Rad, 2002). One result is that several state agencies in 2001 and 2002 conducted rapid visual surveys of all their buildings with replacement values exceeding $1 million: about 400 buildings in all. This is an important first step toward identifying mitigation priorities.

[6] The 1995 legislature also introduced 13 other bills related to earthquakes and tsunamis. One bill added four members to OSSPAC, and another provided tax credits for seismic rehabilitation of historic properties.

THE ADVOCATE AND THE LEGISLATOR

DOGAMI is an independent state agency. According to its website, "It has evolved from its early focus on mining to become Oregon's major source of information to help Oregonians understand and prepare for the vast array of natural hazards that accompany the state's spectacular geology." In addition, DOGAMI has a mandate to actively reach out to potential users of the information, which means that DOGAMI is not just a scientific agency, but is also engaged in public education, advocacy, and coalition-building. Over the past decade, DOGAMI has worked at achieving a long-term goal to inventory and evaluate earthquake risks in the state. This includes geologic hazard mapping, ATC-21 building surveys, and HAZUS loss estimates. By strategically pursuing partnerships throughout the state, DOGAMI has leveraged its resources and made remarkable progress toward this goal.

Yumei Wang, Geotechnical Engineer and Geohazards Team Leader for DOGAMI, has played a key role in this work since the early 1990s. In addition to her geotechnical skills, Wang has also pursued policy interests. She was appointed to OSSPAC in 1999, and served as Chair in 2000. She also spent one year as an ASCE Congressional Fellow, serving on the staff of Senator Edward Kennedy of Massachusetts beginning in September 2000.

Wang's educational background is in geology and geotechnical engineering, and she was working as a geotechnical engineer in San Francisco[7] when DOGAMI advertised in 1994 for an earthquake engineering position. Although this involved a pay cut, Wang was intrigued by the possibilities of research, publishing, and working with the media. In addition, she says that she always found earthquakes to be the most exciting part of geotechnical engineering.

After several years of publishing maps, Wang began to ask how to best increase public *use* of the maps. More fundamentally, she realized that the larger question involved how to best advance seismic safety. She saw the public policy arena as an important way to achieve this goal. Her subsequent work for OSSPAC and as a Congressional Fellow has shown her that individuals can successfully affect policy. "It's not that hard," she says.

More recently, Wang had the opportunity in 2003 to join a post-earthquake reconnaissance of the devastating earthquake in northern Algeria. She says that seeing the actual effects of an earthquake on people's lives has given her renewed energy to make Oregon a safer place to live.

Senator Peter Courtney was elected to the Oregon State Senate after having served for seven terms as a state representative (where he was the House Democratic leader), representing the Salem area. In 2003 he was unanimously voted to be the President of the Senate. Courtney had no knowledge of earthquakes prior to his appointment to OSSPAC. He grew up in the East, went to the University of Rhode Island and Boston

[7] She was working at PG&E for Lloyd Cluff, who also appears as a key player in the Utah seismic safety advocacy story.

University, and moved to Oregon in 1969. His background is in political science and law, with little physical science education.

The Governor appointed Courtney to OSSPAC, as the legislative representative, in 2000. According to Courtney, he has no idea why this happened. He is a generalist, with primary interests in children and corrections, and he had no previous experience in any topics related to seismic safety.

When Wang became Chair of OSSPAC, she began by contacting all the members. She visited Courtney and talked to him about earthquake hazards. As his understanding of the risk increased, so did his interest, and he began to attend OSSPAC meetings. The statewide HAZUS study was influential in explaining the risk to him in human and economic terms. And, in fact, Courtney did know something about earthquakes, as he had had first-hand experience with one in 1993. He felt the earthquake at his home in Salem, he could not meet in the Capitol while it was undergoing repair, and he saw the church he was married in damaged and closed.

Sen. Peter Courtney and Yumei Wang

Photo: Robert Olshansky

OSSPAC developed the bills in 2000, after many meetings with stakeholders and key agencies. Wang called Courtney every few days about the bills, because she felt that he was a well-known legislator who was in a position to make change. He agreed to the concept of the bills and eventually agreed to sponsor them. They decided to go with a set of three bills and two joint resolutions rather than a single bill. They discussed each bill with stakeholders, such as organizations of hospitals and higher education.

Courtney took his mission seriously. Once committed to the bills, he was committed to getting them through the legislature and the election. He became "the quake kid" of the Oregon legislature, as he tried to convince others of the importance of the bills. He explained the purpose of the bills to his colleagues, and the many stakeholders who testified in support of the bill were also persuasive. Courtney says that he carefully wrote the ballot measures in simple terms so that anyone could understand them.[8] He was not optimistic, however, about the chances of the voters approving the ballot measures. The November 2002 ballot was long, and, although the measures had no opposition, neither did they have any visible constituency. Seismic rehabilitation is technical, and not a high-profile issue. Furthermore, because he was in his own brutal campaign for re-

[8] Courtney says he always tried to use the work, "quake," rather than "seismic." The latter term sounded too frighteningly technical to most people. But somehow the ballot measures said "seismic rehabilitation," and he missed the deadline for changing the words. He was worried that this simple error would doom the measures to failure.

election, he was not able to campaign for the two measures. In addition, he was hospitalized with a serious case of appendicitis the week before the election. In the end, Courtney won his re-election with 55% of the vote, and both ballot measures passed. Courtney still does not know how the measures passed; voters turned down other measures that addressed much more immediate issues. It would be helpful to readers of this case if we could pass on words of wisdom to help others pass similar measures in their states or municipalities, but we cannot quite do that. Still, it is clear that several aspects were helpful:

- DOGAMI, OSSPAC, Metro, and other agencies had successfully increased earthquake awareness among the state's population;
- The 1993 earthquakes and the 2001 Nisqually, Washington earthquake helped to increase seismic awareness;
- Through OSSPAC and through the legislative process, stakeholder groups had the opportunity to review and comment on the bills, which ensured that the legislation had no formal opposition.
- The ballot measures contained strong statements of support by respected and credible sources, with no written opposition.
- The ballot measures clearly stated that they would not raise taxes.

Courtney's mission is still not quite complete. The Ways and Means Committee must first appropriate $1.2 million to do the initial studies before the state can issue the bonds. And Oregon's budget is very tight this year, affecting many essential services. So it will still take some time. But, as Courtney notes, these five pieces of legislation are remarkable. He thought it could not be done, especially in a budget crisis. Although the job is not yet complete, these measures demonstrate public commitment to seismic safety.

Lessons for Advocates

- The scientific foundation is a critical first step, and people will pay attention if it is communicated clearly. The U.S. Geological Survey played a key initial role, not only in identifying and documenting the seismicity of the area, but also in describing it in understandable ways to public audiences.

- Advocates can develop concern for seismic safety even in the absence of major earthquakes.

- But earthquakes help. The 1993 earthquakes gained the attention of the state in general and legislators in particular. When an earthquake damages the State Capitol, legislators are ready to listen.

- The message must be clear, relevant, and repeated. It is important to personalize the issue for the intended audience. Organizations in Oregon have worked hard to describe earthquake risk in terms stakeholders can understand, using maps, lists of buildings dollar losses, and casualties.

- Seismic safety needs to be expressed in plain English. Both Courtney and Wang emphasized this advice. For example, they used the term, "quakes," rather than "seismic safety."

- State-local partnerships help to expand the constituency for seismic safety. Several Oregon localities have performed their own seismic risk studies, with state assistance. This gives them ownership of the results, and enables them to become more effective advocates and supporters of seismic safety.

- Seismic safety advisory bodies are valuable mechanisms for creating and furthering policy. Over the years, OSSPAC represented a continuing forum for seismic safety, in which agencies and experts could trade knowledge and ideas, and stakeholders could express their concerns. The legislative and ballot achievements could not have happened without such a body.

- Legislative action requires teamwork. In this case, an astute state official, an experienced legislator, and a group of dedicated commission members were able to develop and advance the legislation.

- Stakeholders need to be on board before the bill is introduced. Stakeholder participation ensures stronger bills. And it minimizes opposition—in this case, by the time the bills reached the legislature they had no organized opposition.

- Enacting legislation requires an experienced legislator. Courtney knows the mechanics of turning a bill into a law, and he knows the other legislators. He carefully wrote the bills with the legislative counsel, found an appropriate committee for them, and arranged for stakeholders to testify.

- Legislators are human, and they need the support of advocates. Courtney needed the constant positive feedback that Wang provided in order to keep him enthusiastic about the issue.

- Adoption of legislation is not the end. Policy making continues through implementation. In this case, the legislation was the first step, the ballot measures the second step, and more steps exist ahead. In fact, these steps have already begun. OSSPAC is working on a general obligation bond for $50 million, and Wang is working on mobilizing support for it in the next legislative session in 2005.

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Example Eight
Advocacy Vignettes From California

California, because of its unfortunate position as the nation's leader in damaging earthquakes, has long been a leader in seismic safety. Virtually all the nation's seismic safety innovations began in California, including the 1933 Field Act for seismic safety of public schools, development of modern seismic building codes from the 1950s through the 1970s, the 1972 Alquist-Priolo Act that prohibited construction atop active faults, the 1972 Hospital Seismic Safety Act, the 1975 advent of the Seismic Safety Commission, and the 1986 Unreinforced Masonry Building Law that required all jurisdictions to develop programs to minimize earthquake losses from URM buildings.

The various laws and initiatives are so numerous and the evolution of policies so inter-related, that an entire book could be written about them. Indeed, at least one such book exists: *Science, Risk, and the Politics of Hazard Mitigation*, by Carl-Henry Geschwind (Johns Hopkins Press, 2001). Many advocates have played important roles, they have gained the support of legislative champions, and seismic safety actions have enjoyed widespread support in many communities. [9]

Despite the institutionalization of seismic safety in California, it did not occur (and is not occurring) by itself. Innovative organizations and energetic individuals took important actions at key moments in history. And, because California is still not earthquake-safe, there continues to be need for more advocates to advance the cause. This section presents three such examples: the key role played by an early seismic safety pioneer, the Seismic Safety Commission's effective use of a window of opportunity, and the crucial role of a local city council member in initiating a wave of seismic safety activities in Berkeley.

I. KARL STEINBRUGGE: SEISMIC SAFETY PIONEER

Karl Steinbrugge was a structural engineer and Professor of Structural Design at the Department of Architecture at the University of California at Berkeley from 1950 until his retirement in 1978. He also was Manager of the Earthquake Department of the Pacific Fire Rating Bureau in San Francisco (now the Insurance Services Office). The following account comes primarily from obituaries written by Lagorio and Bertero (2001) and Lagorio and Olson (2002), as well as from Steinbrugge (1968) and Geschwind (2001).

His greatest scientific contribution was his investigation of the effects of earthquakes on structures. His estimates of earthquake losses on different types of buildings are still widely used. After the Kern County earthquake in 1952, Steinbrugge conducted a careful inspection of the damage that occurred, and then meticulously documented and catalogued his photographs and slides. This was the beginning of a collection of photos

[9] There is even an organization—The California Earthquake Safety Foundation—that annually presents the Alquist Medal for Achievements in Seismic Safety to long-time seismic safety advocates. It is named after Alfred Alquist, one of the most significant legislative champions for seismic safety and a long-time member (and legislative author) of the Seismic Safety Commission.

of the effects of earthquakes all over the world, from 1952 through 1989. He used the collection for his own teaching, research, and consulting, and eventually it became a resource for others to use. In 1992 he donated his collection of 5,800 slides and over 10,000 photographs to the University's Earthquake Engineering Research Center. His collection is now digitized and available online at http://nisee.berkeley.edu/visual_resources/steinbrugge_collection.html.

Steinbrugge was an active member of organizations that themselves were seismic safety pioneers. He joined the Structural Engineers Association of Northern California in 1947 and the Earthquake Engineering Research Institute (EERI) in 1954, and he was the president of EERI in 1968-69. He was also a member, in the late 1960s, of the State Mining and Geology Board, where he strongly supported increasing the mapping of geologic hazards throughout the state.

What distinguished Steinbrugge from many of his engineering colleagues was his enormous contribution to seismic safety policy. In 1968 he published a monograph through U.C. Berkeley's Institute of Governmental Studies, entitled *Earthquake Hazard in the San Francisco Bay Area: A Continuing Problem in Public Policy* (the editor of this monograph series, Stanley Scott, was also a significant pioneer in seismic safety policy in California). This 80-page monograph is a masterful and concise overview of the elements of seismic safety policy. It introduces the reader to the various aspects of seismic hazard in the region, describes how earthquakes affect buildings, presents an overview of the responsibilities of relevant government agencies, and then presents policy recommendations. The Introduction makes clear that the purpose of the monograph is to emphasize "the public policy aspects of *pre*-earthquake [italics in original] planning, which can minimize the effects of a disaster."

Steinbrugge's 1968 policy recommendations provided an outline that guided the development of California earthquake policy for many years. They have three aspects. First, he observed that the standards for new buildings in California are "among the highest in world." Even so, this does not solve all the aspects of the earthquake problem. Second, he recommended land use and design restrictions for areas of geologic hazard: in active fault zones, on Bay fill lands, and in potential landslide areas. To address geologic hazards, he recommended some type of Bay Area regional government. Third, he recommended "cities to begin planning ways and means of developing programs to minimize the hazards of older buildings."

Steinbrugge's recommendation for a regional government was picked up by Stanley Scott, who argued for a Bay Area earthquake commission, modeled after the recently established Bay Conservation and Development Commission (for regulating development on the shorelines of the Bay). State Senator Alquist learned of this idea through a staff member who had met with Steinbrugge and Scott, and he drafted a bill creating a Bay Area earthquake commission. Although this never passed, it is significant in that it was Alquist's introduction both to the seismic safety issue and to Steinbrugge.

Three years later, following the 1971 San Fernando earthquake, California got serious about seismic safety, and Steinbrugge was in the lead. Steinbrugge was without a doubt the lead architect of seismic safety policy in California during its formative years. He worked with Senator Alquist, overseeing the work of nearly 70 advisors to the Joint Legislative Committee on Seismic Safety, a body (chaired by Alquist) that incubated some of the most significant pieces of California seismic safety legislation: the Hospital Seismic Safety Act of 1972, the Alquist-Priolo Special Studies Zones Act of 1972 (for regulating construction in active fault zones), and the Seismic Safety Commission Act of 1974. Steinbrugge also served on the Governor's Earthquake Council, helped to form the Seismic Safety Commission and served as its first chairman. According to Geschwind, it was Steinbrugge and geologist George Gates who, in 1972, first suggested the idea of an independent commission that would have responsibility over earthquake hazard reduction policy. Their intent was to give seismic safety a permanent presence in Sacramento after the Joint Legislative Committee expired in 1974. Steinbrugge drafted the Seismic Safety Commission bill, which the Committee called its "single most important" recommendation.

After the Federal Earthquake Hazards Reduction Act was enacted in 1977, Steinbrugge was called to Washington to help to shape that effort as well. He was appointed chairman of the Working Group on Earthquake Hazards Reduction in the President's Office of Science and Technology. In 1978, under his direction, the group published *Earthquake Hazards Reduction: Issues for an Implementation Plan.*

Shaping seismic safety policy both for California and the nation within a single decade should have been accomplishment enough for anyone. Through all of the policy work of the 1970s, however, Steinbrugge continued to investigate earthquakes and publish reports of effects of earthquakes on structures.

Lessons for Advocates

- Steinbrugge had a clear vision of where seismic safety policy should go. Although most advocates will never find themselves in the fortuitous position Steinbrugge was in—to be able to advance most of the vision—it is nonetheless helpful to have a coherent plan to guide yourself, guide the efforts of others, and communicate with others.

- Legislators need help. Once they develop an interest in seismic safety, they will turn to those with more knowledge—you—to help to craft policy and develop appropriate legislation.

- Although a large number of people were involved in this topic at the time, Steinbrugge showed that one person--with energy, dedication, and vision--can make a significant difference. Because of his policy vision, the state was able to do more than simply react to the San Fernando earthquake. The Seismic Safety Commission in particular is not only a permanent legacy that Steinbrugge left for California, but it has served as a model for such organizations in other states as well; as we show in many of our cases, these organizations are instrumental in advancing seismic safety.

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II. CALIFORNIA SEISMIC HAZARD MAPPING ACT: USING A WINDOW OF OPPORTUNITY

This example shows how important it is to craft policies ahead of time and have them "on the shelf" when windows of opportunity open. In this case, it had not been on the shelf for very long when a particularly fortuitous window opened: the Loma Prieta earthquake, which caused ground failure in the home district of the Speaker of the California Assembly. Despite this, it took a second window—the 1994 Northridge earthquake—to secure adequate funding for the program. Incidentally, this case also shows how the legacy of Steinbrugge's vision—both in the substantive need to develop hazard zoning, and in the institutional value of a seismic safety commission—continued to guide seismic safety policy 21 years after publication of his monograph. The following account comes from the recollections of Tom Tobin (Executive Director of the Seismic Safety Commission at the time), and from this author's own previously-published summary (Olshansky, 2001), which in turn came primarily from Tobin (1991) and Real and Holden (1991).

The California Seismic Hazards Mapping Act, enacted in 1990 shortly after the 1989 Loma Prieta earthquake, extended the principles of the Alquist-Priolo Act to areas of ground failure and strong ground shaking. The genesis of this Act actually goes back to the 1971 earthquake, when the legislature rejected a broad mapping program and decided instead to focus only on fault rupture zones. The Seismic Safety Commission, however, persisted over the years in asking for a broader, more comprehensive program.

In the 1986 publication, *California At Risk* (a 5-year program statement, required by the California Earthquake Hazards Reduction Act of 1986), the Commission called for an Urban Geological Hazards map series for the most seismically active areas expecting future development. The map series—addressing fault movement, ground failure, landslides, liquefaction, and tsunami hazard—would require $300,000 per year to produce. In 1987 the legislature directed the Division of Mines and Geology to design a program that would provide improved information on seismic hazards to property owners. This study was underway when the 1989 Loma Prieta earthquake struck.

Shortly after the earthquake, Willie Brown, the powerful Speaker of the State Assembly, asked the Commission to help draft an appropriate earthquake safety bill for him to carry. The Seismic Hazards Mapping Act was the perfect bill for this situation, for several reasons. First, it was a priority activity previously identified by the Commission and supported by the California Division of Mines and Geology in their nearly completed report to the legislature. Second, although widely supported in principle, it needed explicit funding by the legislature, which would be most likely to provide it immediately after a devastating earthquake. Third, it was a major new initiative, requiring not only money but also the power to overcome the real estate interests which had for nearly 20 years resisted expansion of the Alquist-Priolo Act. The combination of the powerful Speaker of the Assembly with the wide public support for seismic safety legislation common after large earthquakes provided the necessary political will to pass this bill—in fact, this was probably the only way this initiative could ever become law. Fourth, the bill's topic was tailor-made for the support of Speaker Brown, whose home district included the Marina District of San Francisco, which, despite being far from the earthquake's epicenter, suffered considerable damage due entirely to soft soils.

In addition to directing the State Geologist to prepare appropriate maps, the SHMA requires several actions by local governments: posting of the official maps at the county offices, recording of the maps by the county recorder, requirement of a geotechnical report prior to the approval of any project in a seismic hazard zone, submittal of all approved geotechnical reports to the State Geologist, and consideration of the maps in preparing the safety element and in "adopting or revising land use planning and permitting ordinances" (Calif. Public Resources Code, Secs. 2696-2697). In contrast to the Alquist-Priolo Act, which requires only avoidance of the fault trace, the SHMA permits any appropriate mitigation of the hazard, either by siting or design. Finally, the SHMA established a permanent funding mechanism, earmarking funds from the new state earthquake insurance program, as well as from building permit fees. The Division of Mines and Geology study was completed in 1990, and it became the basis for implementing the legislation.

Because of funding delays, as well as the need to establish mapping standards, start-up of the program was slow, and none of the maps had been completed at the time of the January 1994 Northridge earthquake. Therefore, this policy, which had its origins after the 1971 earthquake, and was finally enacted after the 1989 earthquake, was not yet in effect. It was the 1994 earthquake, however, that finally gave the program the boost it needed. Shortly after the earthquake, FEMA provided immediate funding for accelerated mapping of 16 quadrangles in southern California, and FEMA along with California's Office of Emergency Services have continued to provide additional funding. According to the California Geological Survey website, as of June 2003, 81 quadrangle maps have been approved, an additional 20 have been released in draft form, and 17 are in process.

Lessons for Advocates

- Always have a carefully drafted policy or program in your drawer, ready to drop into action should an opportunity present itself.

- Be patient. In this case, it took over 20 years from Steinbrugge's first articulation of the idea until it was finally enacted and funded. Even today, 35 years later, it is still in early stages of implementation, and most of the Bay Area maps are not yet complete.

- Long-term policy plans, such as *California At Risk*, are very helpful. This document served as the source of dozens of bills following the 1989 Loma Prieta earthquake, as well as after the 1994 Northridge earthquake.

- Policy advances often proceed on separate tracks and can reinforce each other, as exemplified here by the work of the Seismic Safety Commission and Division of Mines and Geology.

- Earthquakes provide the best opportunities to make significant advances in seismic safety. Always be prepared to take advantage of them. Do you have a well-articulated policy to propose should an earthquake affect your region tomorrow?

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III. CITY OF BERKELEY: A COMMUNITY CHAMPION ACTS AS A CATALYST FOR ACTION

This example shows that even in an environment full of experts and activists, one person can play an important role in focusing community energy and initiating a set of seismic safety actions. This account comes entirely from the excellent description of seismic safety activities in Berkeley, by Chakos, Schulz, and Tobin (2002).

The City of Berkeley is a unique environment for seismic safety. It includes the active Hayward Fault, steep hillsides, and soft Bay muds. It has a highly educated, politically involved population. And U.C. Berkeley is the birthplace of much of modern earthquake engineering as well as seismic safety policy. As a result, it is not surprising that the City, the School District, and the university campus have all initiated a variety of innovative mitigation policies and safety programs, and the voters have repeatedly agreed to provide appropriate funding for the tasks. What is surprising is that most of these policies were not in existence as recently as 1989.

Chakos, Schulz, and Tobin present a detailed account of a variety of organizations, initiatives, and opportunities that led to the development of several major seismic safety actions in Berkeley. It is beyond the scope of this brief section to describe all the advocates, organizations, events, and interests that brought all this about (although it would be fair to say that the 1989 Loma Prieta earthquake and the 1991 Oakland fire both significantly helped to focus attention on the reality of the natural hazard threat). But one advocate does stand out from the rest. In the words of Chakos et al, “Alan Goldfarb’s interest in seismic safety demonstrates how the persistent efforts of a community champion can build a successful mitigation strategy.”

Alan Goldfarb was elected to the Berkeley City Council in 1986. Having remembered previously reading about earthquake risks in Berkeley, he worked with student interns from the University’s Institute for Governmental Studies (remember the role of IGS in publishing Steinbrugge’s monograph in 1968) in researching the City’s earthquake preparedness. They found that the City was not well prepared. Goldfarb was also the City’s designated representative to the Association of Bay Area Governments (ABAG), which had for many years been a leader in the region in promoting earthquake hazard mapping, risk analysis, and preparedness. He obtained useful information from his involvement with ABAG, as well as from the Bay Area Earthquake Preparedness Project (BAREPP), which worked closely with ABAG. He invited the director of BAREPP to speak to the City Council about the hazard posed by the Hayward fault. The Council showed little interest.

Frustrated at the Council, Goldfarb went to the community level. He began with his Neighborhood Watch group, and then arranged for a BAREPP presentation to a citywide meeting of Neighborhood Watch groups. The response was overwhelming, and community groups became highly concerned about the earthquake threat. As a result, in 1989, the City Council approved formation of a citizen’s advisory Disaster Council. After the October 1989 earthquake, Goldfarb no longer needed to convince anyone of the problem.

Berkeley has over 40 citizen commissions and boards, and participatory democracy is very real in Berkeley. But this also means that many worthwhile issues are competing for community attention. It took Goldfarb’s work to raise the visibility of the issue and to create alliances between community groups and other organizations. Once set in motion, seismic safety became a community value.

The success has been stunning. In four local elections Berkeley voters have approved over $390 million in local taxes to fund mitigation projects. In addition, the City now rebates 1/3 of its real estate transfer tax, up to a maximum of $1500, for seismic retrofit—Goldfarb was the swing vote in agreeing in 1991 to increase the transfer tax only if the Council agreed to the rebate. As a result, over 39% of Berkeley’s 22,000 single-family residences and over 30% of small multi-family buildings now have improved seismic resistance, at a cost to the City of over $10 million in foregone taxes. The Disaster Council—like the Seismic Safety Commission at the state level—has kept earthquake safety on the agenda of the City Council.

In summary, since 1989, some of the key actions in Berkeley have been:

August 1990	Engineering review of school buildings.
July 1991	Transfer tax rebate adopted: rebates up to $1500 of the real estate transfer tax for seismic safety improvements.
June 1992	Measure A: $158 million property tax for school safety programs (passed with 71% of the vote).
November 1992	Measure G: $55 million in general obligation bonds for municipal safety improvements.
1994	Unreinforced Masonry Safety Program: a requirement for owners to retrofit URM buildings.
November 1996	Measure S: $45 million for seismic retrofit of city buildings.
November 2000	Measures AA and Q: $116.5 million in supplemental bonds for school safety program.

Lessons for Advocates

- One dedicated individual can make a difference. This is true even in an activist-filled community such as Berkeley.
- If one strategy is not working, try another. If one audience does not listen, try another. Goldfarb could have given up after his Council colleagues initially ignored him, but he instead considered other avenues.
- The best way to get the attention of elected officials is by the support of the community.
- Advocates should seek to integrate seismic safety into related actions. Rather than design an entirely new program, Goldfarb was able to fund seismic safety through the City's existing transfer tax scheme.
- Earthquakes present windows of opportunity. In this case, the 1989 Loma Prieta earthquake reminded an already-aware population that they needed to take some long overdue actions to improve seismic safety.

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Guidance for Seismic Safety Advocates: Formulating and Evaluating Policy Alternatives

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INTRODUCTION

The purpose of this paper is to provide assistance to seismic safety advocates in developing and evaluating policies and programs to enhance seismic safety that have a high probability of being implemented, have staying power, and be effective. Seismic advocates are skilled at providing technical guidance and developing engineering solutions. Historically, however, apart from new construction building codes in seismically active states, they have had difficulty developing solutions that a critical mass of stakeholders can support over an extended period and can be implemented. We believe that engineering expertise in developing solutions to complex problems of seismic safety is necessary, but, in many cases not sufficient. Many of the problems and solutions have very sizable political, social, and economic elements.

For individuals to take precautions against the earthquake hazard, or for governments to mandate action, for either new or existing structures, they must recognize a significant risk and perceive that they can reduce those risks in ways that make sense to them. The means of reducing the risk must make sense to them in terms of their criteria and not in terms of someone else's. If they are to be enacted and have some staying power, policies and programs must go beyond engineering solutions to meet the needs of those who have a vital stake in how resources are allocated within an individual organization or across a governmental entity. This paper is aimed at helping seismic safety advocates to design policies and programs that make sense from the standpoint of diverse stakeholders and, when adopted, have staying power.

Seismic Safety Advocates Have Met With Mixed Success

Seismic safety advocates have had mixed success over the decades. In fact, outside California, they have had little success. In the public policy arena, they have been able to get governments to incorporate seismic design standards into building codes in a handful of states, but not in other states with severe earthquake risks, even though the marginal cost of incorporating at least basic aseismic design elements in larger buildings with significant occupancy is not particularly high. Advocates have had some success in getting public policies adopted that require retrofit of old buildings, but, often those policies are subsequently questioned by other stakeholders and are sometimes watered down from the standpoint of the seismic safety advocate. As a result, little is being done to reduce the very substantial risks from the large stock of existing buildings that are believed to be unable to withstand even moderate earthquakes. Nor have seismic safety advocates had much success with private decision makers. Across the nation, relatively few private investors have taken enough notice of the earthquake threat to voluntarily build beyond the design and construction standards required by building codes.

The greatest successes for seismic safety advocates have been with new construction in a small number of seismically active Western states. In these states, seismic safety advocates have ensured that seismic design standards have been incorporated into state and local building codes and into infrastructure design and have influenced how construction sites are evaluated prior to design and building.

In California, where the seismic risk is better understood, seismic safety advocates have had limited success in efforts to require retrofitting or replacement of structures built before adequate new codes were enacted. In the case of unreinforced brick masonry (URM) buildings, a coroner's inquest following the 1933 Long Beach earthquake identified unreinforced masonry buildings as having little resistance to earthquake forces. Since that time, cities in California have made significant progress by adopting building codes that prohibited URM building construction. However, it was not until fifty years later and the inventory of unreinforced buildings in the Cities of Long Beach and Los Angeles dwindled to a few thousand that the Cities were able to enact an ordinance requiring them to be retrofitted or removed. Much later, San Francisco enacted local legislation to address its large stock of unreinforced masonry buildings, but the required retrofits are minimal. Finally, the State of California adopted the City of Los Angeles retrofit ordinance as a model retrofit code for the State leading to a few other California communities to adopt codes to address the URM problem; but, to the best of our knowledge, nowhere else in the United States has either state or local government taken steps to protect the public from the seismic threat of hazardous unreinforced masonry structures.

Another example of the limited success seismic advocates have had in retrofit has to do with California's ambitious retrofit program adopted in 1994. That program is embodied in Senate Bill 1953, legislation requiring hospitals built before 1973 to meet updated structural and nonstructural performance requirements, essentially by 2008, and then to be fully compliant with rigorous standards by 2030 or be removed from service. However, due to large number of issues not considered at the time of adoption of the legislation, we are fast approaching 2008 and not much retrofit has taken place. Indeed, efforts are being made by health care organizations to push back compliance dates.

Outside California, Washington, Oregon, and Utah, seismic safety advocates have had very limited success. There are, however, a few glimmers of hope. For example, a bridge spanning the Mississippi River near Memphis (Tennessee) was built to withstand significant earthquakes, largely in response to the threats posed by the New Madrid Fault. Some public utilities along the west coast of the United States have been making serious efforts to make their lifeline infrastructure robust against small and moderate earthquakes. And, in fact, New York City adopted a seismic element in its building code.

LESSONS FROM THE PAST

It is possible to learn from the past, but it is usually easier said than done. Here, we look at two cases, both from California, to illustrate what happens when advocates develop policies that are devised that meet their needs and interests, but that conflict with the needs and interests of others who are affected directly by those policies. The first of these cases is the development of public policies to require remediation of seismic vulnerable unreinforced masonry buildings. The second case deals with the State of California's legislation requiring acute care hospitals built before 1973 to be upgraded to current requirements for seismic safety.

Unreinforced Masonry Buildings

In 1966 the California Supreme Court rendered a decision regarding a hazard in the community stating that if a building official knew of a potential hazard in the community and did nothing to alleviate the hazard and a disaster had occurred, the official could have possibly been held personally negligible (City of Bakersfield vs. Miller, 1966). This decision prompted the building official of the City of Long Beach, California to focus his attention on what he had determined to be a major hazard in the event of an earthquake, the many unreinforced masonry (URM) buildings in the City built before 1933. During 1968, after trying unsuccessfully to get the City Council to support the development of an ordinance to require abatement of the hazard presented by the URM buildings, he started condemnation proceedings under the City's nuisance law on the all of the URM buildings in the City.

This set of actions caused the building owners to form the United Property Owners Association and to file a lawsuit against the City asking the court to rule against the action of the City's building official. During the legal process the City contracted with a consulting engineer to evaluate the risk associated with the URM buildings given the potential for an earthquake on the Newport Inglewood Fault that was the cause of the 1933 earthquake that did significant damage to buildings in the City.

The consultants report classified the risk of death and injury from collapse of URM buildings for different levels of occupancy and years of exposure given an earthquake. A grading system was developed for the purpose of evaluating individual structures to determine their individual risk. The court dismissed the case resulting in the United Property Owners Association and the Downtown Business Associates to join with the City to develop a program to address the risks posed by the URM buildings. They jointly drafted a URM Retrofit Ordinance that was presented to the City Council. At a Council Meeting in December 1970, the City Council, realizing that the heat surrounding the issue had significantly diminished, decided to exercise a parliamentary procedure and table the ordinance to be discussed in public hearings at some later date not specified. This of course pleased the property owners since they were not required to take any specific action to reduce the risk presented by the URM buildings should an earthquake occur.

February 1971 the San Fernando Earthquake caused significant damage to many buildings, including the complete collapse of the Sylmar Veterans Hospital, an unreinforced masonry building, killing 50 people. This earthquake event and the damage and death helped the Long Beach City Council to refocus their attention on the draft ordinance they had tabled in December of the prior year. In parliamentary terms, the Council took the draft ordinance off the table and submitted it to the required three public hearings, formally adopting the ordinance in June 1971. This started the process of abating the risk presented by the existence of over 900 old URM buildings occupied as businesses and residences in the City.

The damage to buildings in the City of Los Angeles caused by the San Fernando Earthquake and the successful adoption and implementation of a retrofit ordinance by the City of Long Beach led the City of Los Angeles to adopt a similar ordinance in January 1981. This seemed prudent since Los Angeles had 8000 of the hazardous URM buildings continuing in use for businesses and residences.

The process of policy formulation and adoption by these two cities in adopting an earthquake rehabilitation ordinance for unreinforced masonry buildings has been carefully examined and presented in a case study by Alesch and Petak (1986). The major lessons for advocates learned from the experience of the Cities of Long Beach and Los Angeles, California are summarized in the following set of propositions (Alesch and Petak, 1986, pp. 223 -234).

"Proposition 1: There has to be recognition by a reasonably large proportion of the policy community that there is a problem--that the hazard exists, that the probabilities of loss are more than trivial, and that something can be done about it that will be politically acceptable.

Proposition 2: In order for hazard mitigation policy to be enacted, there must be an available policy option that includes a technical solution viewed as practical and efficacious by non-technical policy makers.

Proposition 3: The probability that hazard mitigations will be enacted is in direct proportion to the extent that there are inside policy advocates who are persistent and tenacious in their pursuit of the policy, who have access to policy makers, and who have credibility among policy makers.

> Corollary 3.1: The need for the persistent inside advocate is a prerequisite for hazard mitigation enactment in the case of innovators and early followers, but diminishes gradually in other communities as the mitigation policy is adopted by increasing numbers of jurisdictions.

Proposition 4: Windows of opportunity are essential for hazard mitigation policy to be enacted. Windows can be pried open with enormous, continuing effort, but they open automatically in the event of a low probability/high consequence event that demands community attention because of geographic proximity or other reasons.

> Corollary 4.1: It is not necessary for there to be an earthquake or other hazardous event for a window of opportunity to open; a credible forecast or foreshadowing of the event will frequently open the window at least a crack.

Proposition 5: Most hazard mitigation policies are enacted in the period immediately following a low probability/high consequence event.

> Corollary 5.1: Most inside advocates for hazard mitigations are not prepared when windows of opportunity open.

Proposition 6: Hazard mitigation is not technical exercise; it is inherently and often intensely political because mitigation usually involves placing cost burdens on some stakeholders, and may involve a redistribution of resources. Hazard mitigators must, therefore, develop political as well as technical solutions.

Proposition 7: Because values and perceptions are so different among stakeholders, it is difficult, if not impossible, to reach consensus about appropriate mitigation policy interventions.

Corollary 7.1: Because stakeholders in hazard mitigation politics have dramatically different perceptions of the situation and hold different values of risks and outcomes, achieving sufficient political agreement on a mitigation policy requires that trade-offs be made among the extent of hazard reduction, the total costs of mitigation, who pays various costs of mitigation, the level of safety achieved, adverse economic impacts, the level of residual hazard, and political possibilities of passage.

Corollary 7.2: Hazard mitigation policies that cost stakeholders money and threaten their livelihood will be challenged in court.

Proposition 8: Hazard mitigation policies can be enacted even when policy makers have (1) no explicit rationale for government action to mitigate the risk, (2) no information concerning whether benefits deriving from the mitigation will exceed the costs, and (3) no information about whether the proposed mitigation is more or less cost-effective than alternative intervention designs.

Proposition 9: Hazard mitigators are frequently willing to require other people to spend more of their money on hazard mitigation than they want to or may be able to afford, given other priorities. On the other hand, most people discount low-probability/high consequence events heavily, have faulty perceptions about the probabilities of risky events, and often expect others to bear their costs when the hazard strikes.

Proposition 10: Policy makers tend to look at relatively simple data about financial costs and the allocation of cost burdens, rather than at more sophisticated and complex analyses concerning economic impacts, optimality, net present value, and cost-effectiveness.

Corollary 10.1: Most elected policy makers are relatively naive about contemporary methods of policy analysis that can provide information about the consequences of alternative choices available to them.

Corollary 10.2: So are most hazard mitigation advocates.

Proposition 11: Professional associations are a primary means of communicating innovations in hazard mitigation among jurisdictions; jurisdictions that have frequent representation at professional meetings and conferences will tend to adopt innovative policies more rapidly than jurisdictions that do not."

Proposition 12: The probability that mitigation policies will be enacted is directly proportional to: (1) the extent to which the mitigation technology is known and tested, (2) the ability of advocates to describe the consequences of implementation, including the level of costs, who will bear the costs, and the level of hazard reduction being purchased by the mitigation, (3) the number of other similar jurisdictions that have enacted similar hazard mitigations, and (4) the perceived imminence of the hazard.

California Hospitals SB 1953

The 1971 San Fernando Earthquake in the Los Angeles region prompted the State of California Legislature to enact a statute requiring all new hospitals built after 1973 meet advanced seismic standards. In 1994, following the Northridge Earthquake, the California legislature addressed the seismic hazard posed by the large number of pre-1973 hospital structures continuing in use since 1973 by enacting legislation that has come to be known as SB1953. SB1953 requires that 447 acute care hospitals built before 1973 be brought up to contemporary structural and nonstructural seismic standards.

SB 1953 looks like reasonable legislation on the face of it. The legislation makes it possible for acute care hospital facility owners to meet the structural requirements in two stages; one by 2008 and the second by 2030. Nonstructural compliance was to be achieved separately by another, earlier date. It was believed that these dates were far enough in the future to provide sufficient time for compliance. After all, the affected hospital facilities would be more than 50 years old by the time final compliance was required. Moreover, one would be hard-pressed to find someone who does not support seismic safety in hospitals. Certainly, acute care hospital patients and staff should be safe from seismic hazards. And, it would be good if hospital facilities were to remain functional following an earthquake and capable of providing treatment to injured victims.

It is now nearly a decade later. Implementation of SB 1953 has proceeded neither particularly well nor without incident. Relatively little hospital rehabilitation has occurred as a consequence of the legislation, except with regard to the non-structural elements. Efforts have been made and are still being made by healthcare organizations to modify the provisions of the legislation or to delay the deadlines for upgrading. There is considerable doubt as to how it will all turn out.

Nothing is as simple as it first appears. Hospitals and their associations appeared generally supportive of SB 1953 when it was first proposed. Perhaps the primary reason for that support was the looming prospect of an alternative draconian legislative proposal working its way through the legislative process. If it had been enacted, it would have required that virtually every hospital in the state be rebuilt to extraordinary seismic standards within a few years of passage. Once SB 1953 was in place and provisions started to take effect, however, hospital responses to it varied widely. Those responses ranged from public support, lukewarm public support, to attempts to weaken or repeal the legislation, dogged acceptance, and outright defiance.

The original recommendation for policies, eventually embodied in SB 1953, were developed by the California Seismic Safety Commission. Much to its credit, the Seismic Safety Commission recommended that the State help pay for the improvements, but that recommendation got lost along the road to enactment. Consequently, California hospitals are faced with having to finance the retrofit by themselves.

Some hospital organizations view themselves as caught in a terrible bind. They do not believe they have sufficient resources to meet SB 1953 provisions by the targeted dates. Thus, their only perceived option is to delay, hoping that there will be legislative relief or, if there is none, challenging the State of California to close them for failing to comply. Closing those healthcare facilities would presumably leave large numbers of unhappy voters without readily available healthcare.

A significant number of healthcare corporations, including some of those working to achieve compliance, have applied for the extension to 2013, or continue to propose changes or elimination of the provisions in SB 1953. Some of the hospitals seeking changes in SB 1953 have been working through the California Healthcare Association that represents its member hospitals in Sacramento, lobbying for legislation and regulations that serve its members. Many of the member hospitals see SB 1953 as imposing a very substantial burden on them – a burden that they are unable to cope with at present. Over the past several years, the Association has worked with member hospitals, legislators, and other interests to try to find a way to ease that perceived burden. It is likely that the efforts would have been successful, had the hospitals been of one mind about what should be done. As it turns out, they find themselves in dramatically different circumstances from one another. Creating a coalition of diverse interests and holding it together long enough to get legislation passed is difficult, even when all the organizations you represent are of one mind. However, when they are not of one mind, it becomes almost impossible.

Hospitals have also worked outside and apart from the Association to effect changes in SB 1953. At least one hospital corporation, with many facilities, convinced a legislator to seek relief for hospitals from what they perceive as the onerous burdens imposed by SB 1953. Thus far, the relief sought by hospitals has not been entirely realized. California did, however, offer some relief by adopting a law granting hospitals the ability to apply for an extension of the 2008 deadline to the year 2013, if they met certain conditions. At present, about 140 hospitals have pending or approved extensions.

The apparent reluctance of some healthcare organizations to immediately comply with SB 1953 is not because they do not care about seismic safety for hospital patients and workers. In fact, several administrators acknowledged that, based on the experience of the Northridge earthquake, immediate implementation of the non-structural requirements appears to be the most important since the real cause of loss of hospital function was the non-structural element failures. There were no structural collapses, thus there were no deaths or injuries from structural failure. Based on the Northridge earthquake experience, there appears to be the perception among hospital administrators that acute care hospital facilities were safe from collapse due to any earthquake that might occur over the next decade or two. And, given that the real problem was non-structural system failures, the legislation did not permit limiting retrofit to this area. Even so, administrators tend to believe that, if it were it financially feasible, pre-1973 acute care hospitals should be upgraded to meet more stringent seismic designs.

It is easy to oversimplify the reasons for the diverse responses of individual hospitals to the mandates posed by SB 1953. One may quickly conclude that a hospital response depends on the extent to which the governing bodies of those hospitals are committed to the safety of their employees and patients, their commitment to community service, and their financial capability. In reality, the story is much more complex. To gain a better understanding of both hospital responses and ways to overcome obstacles to enhanced seismic safety, it is necessary to develop an understanding of the context within which hospital decision makers make choices.

The main reason that the provisions of SB 1953 appear to have met with so much resistance from some healthcare organizations and, also, from some of the structural engineers working with them, is that the healthcare industry has undergone massive structural and financial changes since SB 1953 was conceived and enacted. The rapid changes in healthcare economics and the bewildering structure of the industry created an incredible uncertain and unpredictable environment for many healthcare organizations attempting to make reasonable business decisions across a wide spectrum of problems and issues.

Technical Complexities

On the face of it, requiring retrofit by 2008 and rebuilding by 2030 for healthcare facilities built before 1973 makes sense. But, things are not always as simple as they first appear. As structural engineers began to examine retrofit options for individual structures, the engineering problems for some larger facilities became much more complex than anticipated. This was largely because of the way some older hospitals have been built and later modified, and because of complex logistical questions. The challenge was no longer simply an engineering challenge. One is hard pressed to know where to start or how to approach the inextricably interwoven aspects of the financial, technical, and logistic problems. SB 1953, designed for a simpler decision making environment, posed demands that were nearly impossible for some of the healthcare organizations to meet, but which, on the other hand, were not all that difficult for others. The burden of compliance fell unevenly among the healthcare institutions.

In the simplest cases, structural engineers evaluated pre-1973 buildings, determined ways to make them compliant with SB 1953, and submitted plans to the California Office of Statewide Health Planning and Development for review. However, in more complicated cases, the costs of structural and nonstructural retrofitting of the existing building was estimated to be very expensive -- perhaps more than half the cost of simply building a new building. Healthcare administrators were suddenly faced with an unexpected choice. Should they skip the retrofit step altogether and simply build a new building now? It would seem to make more sense. After all, facilities built before 1973 are inefficient in terms of today's medical practice, require significant maintenance compared with new facilities, and retrofitting while caring for patients in the same building is, at best, extremely difficult. But, alas, thinks the administrator, it is now 2000. How can I acquire land, design, finance, and build a hospital by 2008? Some organizations have been engaged in capital planning for new facilities and have available resources to do it. Others, faced with a current and future cash crunch, cannot. For them, the cost of retrofitting the old building and then facing another major capital expenditure to build a new facility just a decade or so later is also highly unappealing. Perhaps, some reasoned, we could avoid the 2008 deadline if we were to commit to building a new facility by, say, 2013. Consequently, some hospitals pressed hard for the change in the legislation that would enable them to do just that.

Sometimes, the problem gets even more complex. One of the difficulties some healthcare organizations have with complying in the mandated sequence for specific facilities stems from the way the hospitals and hospital campuses were built. Hospital buildings tend to grow incrementally, adding a wing and then another. A new building is wrapped around an old building. One building, having been renovated a number of times, becomes the first building of a campus of buildings tightly clustered on a land parcel surrounded by other land uses.

Consequently, situations exist wherein a large hospital consists of a non-complying core tower with attached wings that, because they were built after 1973, comply with seismic standards. Often, the noncompliant core structure houses the infrastructure systems for the new wings, linking them like Siamese twins. Some hospitals are faced with the ugly prospect of having to tear down one or more new, complying structures to retrofit or replace an adjacent or attached noncompliant structure.

For healthcare facilities with multiple buildings packed onto a single, crowded site, the logistics problems can be more complex than the retrofit or replacement design problems. Acute care facilities cannot simply be closed while the old building is torn down and the new one erected; it is necessary to remain open for business while complying with the seismic retrofit law. For healthcare facilities where buying additional adjoining land is not an easy option, logistic problems raise additional specters. "Should we build on the parking lot while continuing to operate the old acute care facility? Where else can we build? How will we handle cars, traffic, and parking in the interim? How must we redesign support services and systems to support the new facility in the new location?"

As a consequence of the incredible diversity among facilities, the cost of compliance varies dramatically among them. The highest costs are not necessarily for the oldest or most vulnerable structures. For many of the organizations, retrofit costs would be, essentially, dollars spent simply to add a couple of years of life to an already inadequate building, prompting them to want to rebuild. At the same time, concern about current operating losses and uncertainty about whether they could repay loans keeps them from making the move to rebuild.

Financial Difficulties

When SB 1953 was enacted, most of hospital organizations were generating operating surpluses. Currently, however, about 80 percent of California healthcare organizations are estimated to be losing money on current operations and have been experiencing operating losses for several years. If those hospitals were able to secure bond financing to pay for seismic retrofits, they would be unable to service the debt in their current financial circumstances. What happened and what are the implications for implementing SB 1953?

Fundamentally, two things happened to change industry's financial situation and structure. First, managed medical care increased dramatically during the second half of the 1990s. Between 1995 and 2005, participation in managed care programs was projected to increase from 12.2 million Californians to 20.1 million. For many decades, hospitals had charged patients for services rendered on a cost-plus basis. In the managed care environment, this is not the case. Competition among HMOs for members forced them to cut payments to hospitals for treatment, often to less than the hospital's cost of providing the service.

At the same time, Medicare was experiencing explosive cost increases. Medicare HMOs in California also experienced explosive growth, with more than 40 percent of California's Medicare population enrolled in 1999. Medical hospital expenses per beneficiary more than doubled from 1970 to 1975 and then doubled again by 1980 (Shattuck Hammond, 2001). The 1997 Federal Balanced Budget Act called for reducing Medicare expenditures by $215 billion over five years. The number of Medicare patients was not declining, so, to meet that goal, reimbursements to hospitals and healthcare professionals for procedures had to be cut. Typically, they were cut to below the providers cost of providing the services. The Medicare Prospective Payment System, created to help achieve the goal, pays hospitals a fixed amount per discharge, based on the patient's general diagnostic group, regardless of the actual cost of treating the patient.

All of this was taking place in a context of rapidly escalating costs for healthcare organizations. The cost of contemporary medical equipment was skyrocketing. The cost of supplies was increasing much faster than the Consumer Price Index. Labor costs, too, increased dramatically, for several reasons. The number of Catholic nuns, devoted women who had provided nursing care for more than a century, declined precipitously. The nuns had worked essentially cost-free in religiously-based hospitals. The rapid decline in free labor had to be made up by hiring nurses who actually expected salaries. Simultaneously, California's population was swelling. More nurses were needed, but by this time, women had more occupational choices than nurse, secretary, or teacher. Hospital work was demanding and did not pay competitively. The availability of licensed registered nurses declined relatively in the face of increasing demand. Some hospitals, unable to staff themselves with the required number of nurses, reduced the number of beds available for acute care. Administrators found themselves with declining revenues per patient, higher direct costs per patient, and the need to allocate largely fixed overhead costs across fewer patients.

The response by hospitals to this new situation was generally rational and rapid. Hospitals and physicians began to reorganize themselves to cut costs. Hospitals sought to develop integrated delivery systems by aligning themselves with groups of physicians. In this way, they anticipated reducing operating costs and coping with "capitation". Capitation is defined as the payment to healthcare organizations from third party payers that provides for a set amount of money per enrolled patient per year, regardless of the number or types of treatment required.

At the same time, individual hospitals merged with one another to create larger organizations in hopes of realizing economies of scale. Bigger, stronger corporations with more assets could presumably benefit from integrated management and operations. Hospital mergers swept across the nation during the 1990s. They peaked in the period from 1995 to1997, during which time more than 680 hospital merger transactions were completed nationally. As one might expect, some mergers were much more successful than others.

In general, California hospitals could not cut operating costs fast enough or far enough to make up for the reduction in revenue and increases in the costs of equipment, labor, and materials. Thus, by 1999 California hospital median operating margins became negative.

In 2001 and in the midst of the financial crisis facing more than half of California's healthcare organizations, California changed nursing staffing ratios from requiring one nurse for every six patients to one for every four patients. Given that current shortage in registered nurses nationally, it is unlikely that sufficient numbers of nurses exist in California to meet those new requirements. The new staffing ratios will not only necessitate expensive recruiting costs, but also increase payroll expenditures further depressing financial operating margins.

In this milieu, investor-owned healthcare organizations with many facilities have fared far better than not-for-profit and publicly owned hospitals. Some will leap to the old assumption that investor-owned is always more efficient than not-for-profit or public facilities. That is not necessarily the case. Large, investor-owned healthcare organizations can pick and choose where and how to provide service. Often they can "cherry-pick" the market, locating in upscale markets and electing to provide services that have favorable reimbursements from insurance and Medicare payers. Public hospitals rarely have that option. Indeed, they are often located in areas where the population is least able to pay. Moreover, local governments are typically tight-fisted when it comes to providing sufficient funds for contemporary capital infrastructure. Not-for-profit hospitals typically have missions to serve particular neighborhoods or communities, whether they are secular or religious-based. Some, but not all, not-for-profit hospital systems can benefit from some of the same practices of investor-owned hospitals.

The financial and structural changes in the healthcare industry have a great deal to do with the differing responses of healthcare organizations to SB 1953. Hospitals that are bleeding financially when they are caught in the dual pinch of declining revenues and increased costs are not likely to easily spend money on seismic retrofitting, particularly when they do not see an immediate and urgent need for it.

At the same time, healthcare organizations that have been able to remain profitable may well be in a position to benefit from the mandated seismic improvements. The costs of retrofits provide legitimate reasons to eliminate "loser" hospital facilities and complexes from their organization, either by selling or closing them. Since so many healthcare organizations are in difficult financial straits, this also presents profitable privately owned healthcare organizations to strengthen their market positions by acquiring desirable facilities and market locations from financially-strapped organizations. In this context, the largest and most profitable privately-owned organizations may try to greatly expand their market share. Unfortunately, some may expand their market share by building on the profitable areas of healthcare, leaving low-reimbursement diagnostic group treatment to public and not-for-profit hospitals.

The result is, depending on an organizations fiscal position and primary organizational objectives, for some healthcare organizations to support SB 1953 and to move forward to comply with its provisions on schedule. Compliance is easier for them since they have more options to deal with older facilities and may directly benefit from the difficulties stressing other healthcare organizations. Other organizations might barely be able to comply, while others will be unable to.

What Went Wrong?

Some of the problems of implementing the policy are because of the policy itself. The policy was designed for a simpler time with a specific objective as the basis, upgrade critical facilities. The structure of the healthcare industry altered the context for the problem; in fact, the context changed so much that many organizations were unable or unwilling to try to deal with it at the same time as trying to survive in a changing health care environment. The policy did not account adequately for the complex diversity among the targeted organizations and structures. The costs, in terms of organizational financial viability, operational implications, and cash flow were not evenly distributed among the healthcare organizations and are perceived by some of the institutions as far outweighing any benefit to them.

Some people, including some of those charged with administering the policy, believe that the problem is not with the policy, but with the healthcare organizations themselves. Notwithstanding their position, many believe the policy needs fixing. It has not been fixed for several reasons. First, the State of California is experiencing massive deficits as a consequence of the current recession and its recent energy crisis. Second, California's term limits statute has the result that no one is in the legislature who was there when SB 1953 became law, and no one who is there now will be in office when implementation deadlines come to pass. Current legislators have other priorities. Thus, term limits have resulted in removing from office those who have institutional memory and would be in a position to consider a "fix" for the problem. Finally, no one has been able to come up with a solution that is acceptable to all current stakeholders. While the policy is not quite in gridlock, progress toward implementation of retrofit is extremely slow.

WHAT HAS BEEN LEARNED FROM THE CASES

We believe a great deal can be learned by examining historical instances in which seismic safety advocates have attempted to have policies enacted that reduce earthquake risk with new elements of building codes or requirements to strengthen existing buildings.

Seismic Safety Advocates Have Had Successes in Getting Policies Enacted

Most, but not all, seismic safety legislation is passed in the immediate aftermath of damaging earthquakes. Like Geschwind (2001), we have learned that it does not always take an earthquake for seismic safety advocates to get policies adopted and implemented. In a few states, like California, seismic safety advocates have institutionalized access to the policy making process. This built-in access enables seismic safety advocates to bring seismic safety policy initiatives forward and to have them placed on the legislative agenda with relative ease. Such access does not exist in states that rarely experience earthquakes.

Implementation Does Not Necessarily Follow Enactment

Americans generally think that, once a policy is enacted, implementation, faithful to the policy's intent, follows automatically. Little could be further from the truth. Calista notes that the number of cases in which implementation does follow smoothly and faithfully from enactment are rare (1986). Indeed, as Pressman and Wildavsky have noted, implementation is simply another political arena within which policy making takes place (1984). We have learned that getting government to adopt seismic safety policies is much easier than ensuring that the same government will retain those policies and ensure they are implemented. Geschwind (2001) reports there were even major political efforts to repeal the 1933 Field Act in California. This 1933 landmark legislation applied seismic design requirements for public school buildings. We have reported efforts intended to revoke unreinforced masonry retrofit requirements and to weaken SB 1953. The story seems to be the same, decade after decade.

Seismic Safety Has a Fairly Low Priority for Those Outside the Field

People get fired up about seismic safety when an earthquake adversely affects them or someone they care about. A massive earthquake in the Middle East, killing thousands, is not likely to generate much enthusiasm in the United States for retrofitting buildings and making building codes tougher. An earthquake in the United States that results in a few deaths, significant building damage, and interruption to people's lives and livelihoods will gain considerable attention, but only for a limited time. Interest falls off proportionally with geographic and social distance from the earthquake and the victims. Most Americans do not expect to suffer significant losses in their lifetime and, for the most part, they are correct in their expectations. Unfortunately, many don't understand the nature of the hazard and the potential for risk reduction. And, many expect the government to bail them out in the remote event of loss. This is largely due to continued political generosity of elected politicians who use the public treasury to compensate those who experience largely predictable natural hazard events without having taken adequate precautions.

The Zealous Advocate and Policy Design

Most seismic safety policies enacted by governments are developed by seismic safety advocates. Often, those advocates are zealous in their efforts, seeing each piece of legislative policy as perhaps their only opportunity to remedy a grievous oversight by public policy makers. Alas, that is frequently the downfall of the policy.

The dominant shortcoming of zealous advocates is that they devise and advocate policies and programs that serve their ends and values. These ends and values are entirely legitimate, but in many cases do not take sufficient account of the legitimate needs and desires of those required to pay for the implementation of the advocated policies or the broader system constraints. The problem with true zealots is that they believe they have a monopoly on truth and insight. They have genuine difficulty seeing issues from the perspective of others and are generally unwilling to compromise. The challenge for seismic safety advocates is to be zealous without becoming zealots.

Since most people and organizations are too busy to monitor all public policy making, it is often relatively easy to get special purpose, special interest enacted, especially when it looks like it is in the public interest. Consequently, zealous advocates are relatively successful in getting governments to adopt policies and programs for which there are few serious opponents before the policy is adopted. Serious opponents arise when a set of stakeholders perceives the costs of the policy to them are significantly greater than their expected payoffs.

Seismic safety policies remain in force when stakeholders affected by the policies see it in their best interests to comply. Where seismic design standards are imbedded in building codes, owners and financiers have concluded either that the marginal cost of integrating seismic safety into the building is appropriate, given the risk, or the political or dollar costs of opposing the standards exceed the costs of complying with them.

The California unreinforced masonry retrofit and hospital retrofit programs grew out of concerns for occupant safety, and in the case of hospitals, the additional concern for functionality necessary to meet critical needs following an earthquake. However, there was a difference in approach to arriving at a policy solution.

In the case of unreinforced masonry buildings in southern California, it took lots of trial and error and an extended period of time for policy advocates and supportive policy makers to come up with policies and programs that met the needs of both the advocates and the owners of the URM buildings. Until the basic needs of the core stakeholders were met, policies that were enacted because of pressure from advocates and urgency triggered by moderate earthquakes were subjected to almost continual efforts to water down or delay the implementation.

In the case of the unreinforced masonry retrofit ordinance adopted by the City of Long Beach, building owners were involved in the process of formulation and adoption. Although the effort in the City of Long Beach was started and pursued by a seismic safety advocate – the City's Building Official – the process immediately became bogged down under the weight of a property owner brought lawsuit. This was followed by a coalition of the Property Owners Association and the Downtown Long Beach Associates (DLBA), who worked in collaboration with the City officials to define the problem of potential building collapse during an earthquake and the solution to reduce the risk of building collapse through the implementation of a retrofit ordinance. In fact, the DLBA paid a portion of the study that characterized the problem, and then engaged an attorney to work with the City Attorney in the drafting of an ordinance. The ultimate result was the retrofit or abatement of all of the unreinforced masonry buildings in Long Beach.

The Long Beach success helped to set the stage for the City of Los Angeles who ten years later completed work on the adoption on their retrofit ordinance for unreinforced masonry buildings. The City of Los Angeles depended almost exclusively on earthquake engineers and seismic experts in the development of their ordinance. They were in fact at odds with the Apartment Owners Association who attempted to stop the policy process through use of the courts. They were not successful. Although, the City of Los Angeles did not actively collaborate with the property owners in the City, they had the benefit of the success in Long Beach in helping to define the scope of the problem and develop a solution. Their success ultimately led to the State of California adopting the City of Los Angeles ordinance as a model code for the State.

In the case of the hospital retrofit policy, it was developed by seismic safety advocates (engineers) who did so without a full appreciation of the difficulty facing the decision makers in the changing and difficult health care delivery environment and the complexity of addressing seismic safety objectives without causing serious problems for legitimate stakeholders. That is, the policy and program designers created programs that did not take the affected system and its environment into adequate account; the proposed solutions focused only on one element of a complex system without regard for the consequences for the larger system. That rarely works out very well. Moreover, the policies were generally inflexible and could not be easily amended as more was learned about the problem and as the context changed.

In the beginning, health care organizations appeared to generally accept the initial legislation. Resistance began to develop, however, when the structure of the health care industry changed greatly and most hospitals began to experience serious financial problems. As the health care economic environment became cloudier and less certain for hospital organizations, the commitment of significant resources required to meet the requirements of the legislation and the regulations became less desirable.

WAYS TO DEVISE MORE EFFECTIVE POLICIES AND PROGRAMS

Seismic safety advocates would be well-served by greater understanding of what it takes to get policies adopted and implemented when considering the earthquake problem which tends to have low saliency with legislative bodies, organizational policy and decision makers, and the general public. For the most part, seismic safety advocates are in the business of trying to sell solutions to the earthquake problem that most people do not believe they have. Indeed, for many people, seismic safety advocates are neither more relevant nor more welcome than the well-meaning people who knock on your door at inconvenient times, offering smiles, literature, and advice on eternal salvation.

In this section, we focus on "how to." We have drawn on a significant and growing body of knowledge having to do with building a critical mass of supporters for a solution to an agreed-upon problem for the purpose of providing help to seismic safety advocates.

Problems, Perceptions, and the Dark Crystal

We see the problems associated with seismic safety as representative of what we call the dark crystal phenomenon. The dark crystal has to do with problem definition. To us, problems are a disparity between one's perceived state of affairs (current or future) and the state of affairs he or she desires. Only rarely do two people with disparate interests or values view a phenomenon the same and, consequently rarely do they have fully congruent definitions of the problem.

The dark crystal stands on a figurative pedestal in the center of the policy arena. It has as many facets as there are different kinds of actors or participants in the policy process. Each facet acts as a lens that is shaped by the value base, perceptions, and interests of the viewer who fashions it. Through that facet, the viewer sees the phenomenon in terms of his or her value base, perceptions, and interests. No two viewers see the phenomenon in exactly the same way and, consequently, define the problem in terms of the view through his or her facet.

This, of course, poses an interesting dilemma. Whose perception is correct and whose is wrong? Actually, all perceptions are correct, at least in the eye of the viewer and his or her value base and interests. The question of who holds truth becomes largely irrelevant. They are all right, to a greater or lesser extent.

The zealous advocate sees issues through only one facet of the dark crystal and wonders how it can possibly be that no one else sees truth so clearly as he or she. Others peering through other facets, look up at one another, puzzled, and ask, "How can that possibly be a problem deserving of so much effort? What is the real objective?"

To the extent that those viewing the phenomenon through their respective facets in the crystal share a commonality of perceptions and desires with respect to the phenomenon, the chances of reaching an accord on what constitutes the problem and what might constitute an acceptable solution becomes easier. Conversely, the less they see they have in common, the more difficult it becomes. Conflict can be resolved in any of several ways. First, since both the participants looking into the crystal and the phenomenon inside the crystal are "morphing," though at different rates and in different ways, it might be that their perceptions and desires become more commonly shared simply because of those dynamics. Then resolution becomes easier. Second, a coalition of viewers might find they have enough in common to simply use raw political power to overwhelm others who are not in agreement. In that case, those who win initially will have to be alert to new coalitions that will seek to overturn or alter the initial policy decision thrust upon them. Third, some "fixer" might walk around the crystal, peer into it through the various facets, and then devise a problem statement and a solution to it that meets the needs of a stable, critical set of actors. Such a solution would have to be Pareto Optimal. That is, it would leave no participant worse off than in the pre-solution situation and make some better off than they were to begin with.

Trying to devise Pareto Optimal solutions is difficult and particularly important to advocates of policies and programs with limited salience. Typically, they do not propose policies that do not have adverse effects on someone. Moreover, it is almost impossible for them to put together a stable political coalition strong enough to enact and maintain legislation. It is important, therefore, for them to propose solutions that meet their needs as well as the needs of others who perceive the problem differently and have a different value mix.

Prerequisites to Policy Adoption

The dark crystal analogy helps us to understand the position of those who study how decisions are made and who have concluded that it is generally rational, but not as one might expect. March and Olsen (1976) developed a model for organizational decision making - the "garbage can" model of organizational decision making. Kingdon (1984) applied the model in describing the public policy process. He explained that although legislators consider policy options and decide their fate, they determine whether an option survives long enough to make it onto an agenda. Getting onto the agenda often requires strong advocacy for defining the problem and articulating a solution.

Fundamentally, the theory behind the model states that four independent "streams" must be brought together in one place before a policy decision about an issue is made. First, a critical mass of decision makers must believe a problem exists and must agree on what that problem is. Second, the decision makers must believe that a workable solution to the problem exists and that they know what that solution is. Third, there must exist at least one persistent advocate for the solution who has access to the decision makers (or who is one of them). This advocate must be able to keep the issue on a front burner, pushing to get it onto an already crowded agenda and in front of decision makers who have more to do than they have time in which to do it. Finally, space must exist on the decision makers' agenda for this issue to be acted upon. If any of the four streams is not brought into conjunction with the other three, no action will be taken. Each of these four elements must be present for policy to be made and for programs to be designed. They are essential prerequisites.

Although a policy may make its way onto an agenda and ultimately be adopted by a public policy making body, there is no certainty that implementation will occur. Those stakeholders required to implement the policy must also accept the definition of a problem and agree that the solution embodied in the policy is appropriate in their context. Simply, they must be in agreement with the policy as a solution to the problem as they understand it. Thus, in addition to the convergence of the four independent "streams", it is important to gain acceptance of the policy by the individuals and organizational decision makers critical to implementation. Addressing the issue associated with the need to gain acceptance by decision makers in multiple organizations, Lober (1997), building on the work by Kingdon (1984), suggested that the complexity created by the need to address multiple organizations or stakeholders requires an approach that allows for their collaboration in the agenda setting process. In the context of the "garbage can" model, this means adding and facilitating an "organizational "stream" to facilitate collaboration necessary to increase organizations and stakeholders understanding of the problem, thereby helping to increase their willingness to accept the selected policy solution option and develop acceptable implementation approaches.

PREREQUISITES TO IMPLEMENTATION

If the four independent streams that comprise the "garbage can" are prerequisites to policy adoption, then stakeholder collaboration in the policy setting process should be a prerequisite helping to increase understanding and acceptance of the policy by stakeholders responsible for implementation of the policy. Collaboration is intended to increase knowledge of the problem, a sense of importance and urgency, a belief that it is in the stakeholder's best interest to act now, and the ability or willingness to act now.

Buying into the Problem

The brief discussion of the dark crystal phenomenon above helps to clarify the difficulty associated with ensuring that people are both aware of a phenomenon and consider it to engender a problem they ought to address. We each have a different set of values and expectations. To be sure, they generally overlap one another in many sectors, but the overlap is not complete. Consequently, we have different priorities. To ensure that a policy, once adopted, is actually retained and that implementation actually follows, most of the primary stakeholders must buy into the existence of a problem. Beyond that, they must buy into a belief that the problem is sufficiently urgent and of sufficient priority for them to have that problem preempt others for attention and resources.

Having a Sense Of Efficacy and an Acceptable Solution

Acknowledgment of a problem is not enough to prompt action. The stakeholder must believe that he or she has an available solution that is generally consistent with personal and/or organizational values. If the stakeholder does not perceive that a viable solution exists or can be created for a reasonable outlay of resources, the problem sits there, weighing on one's mind, but without any remediation. The existence of a solution is necessary, but not sufficient. With it, the stakeholder must have a sense of personal or organizational efficacy and believe a solution exists and capable of addressing the problem.

Believing It Is In One's Best Interests and Having The Capacity To Act Now

Lots of smokers understand that smoking will damage their health, know that stopping smoking is the solution, yet, continue to smoke or to postpone quitting until some later time. Understanding and acknowledging the problem and knowing about a workable solution do not lead to implementation unless the individual or organization sees that it is in their best interests to apply the solution immediately. "Why is it that property or facility owners do not see that it is in their self interest to take steps and invest now to enhance their seismic safety?" First, as discussed earlier, the organization may be engaged in a desperate struggle to become financially viable and does not see seismic safety as a current problem, when, if they don't focus their entire attention on the immediate critical problem, they may not be around to be affected by an earthquake that has two chances in a hundred of happening sometime in the next fifty years. There are limited resources and so many pressing high probability problems competing for the limited resources.

STRATEGIES FOR DEVISING SUCCESSFUL POLICIES AND PROGRAMS

Unless the "customer" believes himself or herself to be in need of your proposed solution, to "tell and sell" is not a very effective strategy. Seismic safety advocates rarely find themselves in a position where builders and developers, lawmakers, and citizens are clamoring to find ways to spend more money to reduce the losses from potential earthquakes. Here is the point: except for a few notable exceptions, enhanced earthquake safety is not a particularly easy sell. Consequently, the prudent advocate should seek to devise policies and programs that serve other needs of other stakeholders as well as providing enhanced protection against earthquake losses. In the next few pages, we describe approaches to policy development that we think are likely to be effective.

Walk Around The Dark Crystal, Peering In From Many Facets

We encourage the advocate to identify the major parties that have a stake in systems within which the advocate seeks changes. Retrofit, in particular, is always a problem. If, for example, one seeks to strengthen old hospitals against earthquakes, then it is appropriate, if not essential, to see the problems associated with that strengthening from the perspective of hospital owners and managers and, perhaps, even the clientele they serve. Devising a policy and then trying to convince those likely to be affected always holds unpleasant surprises for both the affected party and the program implementor.

The only way to get a real handle on the nature of the challenge is to work collaboratively with those who are likely to be affected by attempts to deal with the problem. Working collaboratively does not mean sitting in your office thinking about what the concerns of others might be; it means sitting down with stakeholders, articulating the specific concerns about the risks, and finding out what others see as the complications and opportunities involved with attempting to address the concerns. Working collaboratively does not mean there will not be differences in points of view and perspective; indeed, those differences are the whole point of trying to work collaboratively. The challenge is to learn whether the problem and solutions may be defined in such a way that the affected parties can agree on proposed solutions.

Advocates who work autonomously have considerable control over the details of the policy they design, but, by working autonomously, they give up the likelihood that other interested parties will buy into the solution and that it will be adopted and implemented. On the other hand, advocates who work collaboratively have much less control over how the problem is defined and what solutions are devised, but they have a much greater likelihood of having the solution, once agreed upon, accepted and implemented.

In addition to working directly with owners and operators of systems you hope to affect, it makes sense to try to ascertain whether your concern links up with concerns of others. Certainly the property and casualty insurance industry is a potential ally in the struggle for greater seismic safety. But the industry is also an advocate of greater safety from other perils, including terrorism and other natural hazards. Efforts to increase seismic safety in low risk areas, like the Eastern United States, need to be coupled with multi-peril mitigation in order to be relevant to many organizational decision makers. The object would be to spread the cost across a number of risks to make the solution more palatable to those who would otherwise reject outlays exclusively for earthquake safety.

Understand The System In Which The Intervention Will Be Made

It is risky to tamper with complex systems without understanding the systemic relationships among the parts of the system. It is risky, too, to assume that social, behavioral, and economic systems are static; they are dynamic systems, with participants and relationships changing even as you study or attempt to model them. Unless one understands systemic interrelationships, intervening in dynamic systems almost invariably has unanticipated consequences. Only when one understands how the system works, how it is changing from one state to another, and the influences of each component on others, then one can determine where interventions can be made that have a high probability of achieving the desired outcomes.

The problem analysis and solution-devising approach pioneered in the 1950s and 60s at RAND, the California-based not-for-profit think tank, became known as systems and policy analysis. Appropriately, it has become institutionalized as an effective means for defining problems, modeling the systems within which and for which the problem exists, and evaluating alternative interventions in terms of systemic effects. The challenge for analysts has always been to define the system under study at the appropriate level of inclusiveness. Defining the system too narrowly results in developing solutions that may work at one level or for one set of criteria, but are often dysfunctional or irrelevant for a higher level of analysis and more inclusive criteria. This is as true in the case of earthquake hazard mitigation as it is for employing Asian carp, in Arkansas a few years ago, to keep aquaculture tank farms clean, only to have the fish escape during entirely predictable floods with the fish now threatening the entire Great Lakes aquatic ecosystem. It is important to think beyond ones own narrow interests in order to develop the insight about the likely consequences of the proposed actions for others.

Each of us has a tendency to think in terms of our own criteria. Structural and seismic engineers, for example, typically use benefit-cost ratios as criteria for evaluating solutions. Most organizations, however, do not use benefit-cost ratios, not because they don't know how to use them, but because they are not particularly relevant. Most organizational decision makers must evaluate solutions in terms of multiple criteria; whether they use sophisticated techniques or simple heuristics, most organizational decision makers are looking for saddle points in complex, multi-dimensional space. Benefit-cost analysis is often applied as a narrowly focused single-criterion tool limiting consideration of broader system concerns. Organizational decision makers are more likely to rely on setting specific performance objectives and the application of cost-effectiveness analysis or any of a host of techniques to help them through thorny decision processes. If one wants to gain the attention of other stakeholders when one does not "hold a pat hand," then one needs to frame choices and decisions in terms relevant to those stakeholders.

Seek Pareto Optimal Solutions

Once one is able to understand the problem from the perspective of the whole set of relevant stakeholders, it becomes possible to devise solutions to the problem that are Pareto Optimal – solutions that meet the criteria of most or all of the critical stakeholders. The key to creating policies that really have a good chance of achieving your goals is to make sure that your solution solves other people's problems at the same time. Not only is it a more efficient use of resources, but also it is far more likely to find receptive audiences.

Solutions that are Pareto Optimal are much more likely to be adopted than those that are designed to the limited criteria of a few interested parties and are far more likely to be kept in place long enough to be implemented. They have staying power. That is much more effective than depending on holding together a shaky coalition long enough to get a policy adopted and then hoping for the best.

Devising solutions that meet the needs of a critical mass of stakeholders is not necessarily easy or simple. It takes imagination and, more importantly, it usually takes the direct, collaborative involvement of people with diverse perspectives and representing diverse interests. Multi-disciplinary problem-solving teams were created to deal with just these kinds of problems and they have proven, time and time again, to be much more effective than a team comprising only one set of perspectives.

It is also important for seismic safety advocates to be politically savvy and willing to compromise. Sometimes it is better to take half a loaf than to hold out for the whole loaf and get nothing. Remember, those who do not see things as you do are probably just as rational as you are and just as adamant about how the issue should be viewed.

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Guidance for Seismic Safety Advocates: Gaining Attention

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INTRODUCTION

The intent of this presentation is to provide assistance to those who would advocate for greater safety from earthquakes. The focus is on how seismic safety advocates might gain the attention of persons, organizations, and institutions that can make a difference in reducing the risks to life and property from earthquakes. The primary targeted audience includes those persons involved directly in seismic safety professions. These include structural engineers, architects, and others in the structural design professions, as well as building officials, seismologists, emergency management personnel, corporate and public risk managers, and public planners. While aimed mainly at practicing professionals, the discussion is also appropriate for students in those fields, as well as for citizens concerned with the risks associated with earthquake hazards and who want to induce others to take action to protect the community.

Getting policies adopted, programs implemented, and public and private actions taken in response to those programs are instrumental in achieving the overall goal of enhanced seismic safety. Gaining attention is an essential step in the process.

The Basic Problem

Improving seismic safety has proven to be difficult in the much of the United States, except in the aftermath of devastating earthquakes. The primary reason is that relatively few Americans experience the consequences of significant losses from earthquakes in their lifetime. Fewer people experience losses or die from earthquakes than from a host of other natural hazards, from transportation accidents, or from heart failure and cancer. Part of the reason is that, in the past half century in California and a few other locations, seismologists and structural design professionals have made amazing progress in understanding seismic forces and building stronger structures. While experiencing few deaths and injuries, and property losses from earthquakes, California and 39 other states, continue to be exposed to significant earthquake risk. However, with so many other urgent issues and concerns vying for public attention, it is difficult to get policy makers and the public to focus their attention on improving earthquake safety.

Thus, a case can be made for the need for focusing attention on improving seismic safety in most parts of the United States. A very large proportion of the United States is subject to seismic activity and while, for many areas, the expected return period for large events is more than a century, the events, when they happen, will be large and are potentially catastrophic both in terms of lives lost and economic impacts.

This paper is both descriptive and prescriptive. That is, it is based on conclusions drawn from empirical research and analysis in organizational psychology, decision analysis, and political science. It goes beyond describing how things work and suggests how one can increase the probability of being an effective advocate. The discussion begins with an exploration of the challenge facing advocates and the prerequisites to policy adoption. This is followed by a look at historical efforts to enhance seismic safety with the goal of identifying important lessons from those prior efforts. From this, we draw conclusions and turn those conclusions into guidelines for advocates of seismic safety.

WHO ARE THE LIKELY ADVOCATES FOR SEISMIC SAFETY?

The geographic distribution of seismic events and the infrequency of moderate and large earthquakes in the United States generally define the problem for advocates of improved seismic safety. One should not expect significant public support to limit growth in areas subject to high levels of potential ground motion (except perhaps in very small well understood dangerous areas like Portuguese Bend in Los Angeles County, California), or to have to increase the requirements of building codes to insure stronger buildings. Sometimes, a single book, like Rachel Carson's *Silent Spring*, will generate a mass movement compelling public action. However, the environment and its protection had several advantages that earthquake safety does not. Collectively, society is the reason for environmental degradation; plate tectonics are not caused by human disregard for natural systems. Moreover, the environment affects everyone all the time, making each of us the "victim". One can avoid the immediate effects of earthquakes by choosing not to live where they occur. It is easier to generate a mass movement if the danger is thrust upon all people than it is if people are able to choose to accept or ignore a risk because they desire some amenities that place them in harms way.

Thus, do not expect advocates for improved seismic safety to have much success in creating a groundswell of grass roots support for enhanced seismic safety. That is not to say that advocates could not develop ways to induce some individuals to take steps to reduce their own earthquake risks. As decision makers gain credible information from reliable sources, some will choose to take action; others will not. Millions have chosen to stop smoking, but millions continue to smoke. And, despite the fact that experience has shown that earthquakes will occur with significant force to cause much damage and injury, individuals for a variety of reasons continue to locate their new houses within a stone's throw of the San Andreas Fault or other significant faults.

The most likely advocates for enhanced seismic safety are those who have a personal or professional stake in it. Structural engineers, building officials, and community planners are among the most likely advocates. Structural engineers have financial and professional interests in improving the seismic safety of buildings and other structures. Building officials have professional interests and the interests of the municipal corporation in mind. Community planners tend to think in longer time frames and more systemically than do typical citizens or public officials. A fourth group of advocates is comprised of those people in public and private roles who, largely by self-selection, are concerned with one or more natural hazard risks and who work in some aspect of hazard risk management and risk reduction. These people can be found in state offices of emergency preparedness, local councils for business safety, regional organizations advocating seismic safety, and other organizations with a related focus. This discussion is aimed at the most likely advocates for improved safety from seismic hazards.

WHAT ARE WE TRYING TO ACHIEVE AND HOW ARE WE TRYING TO ACHIEVE IT?

The fundamental goal of seismic safety advocates is to reduce losses from earthquakes, including both the immediate loss of life, injuries, and property losses, and the consequences that follow, including personal and economic disruption. The question for advocates is how to go about achieving that goal. Three basic strategies exist for risk reduction: reducing the frequency or severity of the hazardous events, reducing exposure of assets to the events, and reducing vulnerability of exposed assets to the events. Since it is highly unlikely that we will ever be able to regulate the frequency, intensity, or location of earthquakes, advocates are left with two fundamental strategies. The first of these is to reduce the exposure of whatever it is that is to be protected from earthquake forces. One can reduce risk by moving away from the hazard, not building in the most dangerous locations, or from a community perspective distributing the exposure geographically. Foe instance, one could reduce exposure by distributing population over a large geographic area through limiting building heights and restrictive zoning, or reduce economic risk by distributing economic interests such as warehouses, manufacturing, and other facilities to several locations.

The other instrument for reducing the consequences of earthquakes is to reduce the vulnerability of structures and their contents to earthquake forces. This is what structural and nonstructural engineers and others in the design professions emphasize: given the characteristics of the site, how can we reduce structural and nonstructural vulnerability to acceptable levels? The primary concern then is with actions that affect decisions about where human activity takes place, where structures are sited, and how they are designed and built.

One can achieve changes in human behavior in two fundamental ways. First, one can get government to adopt policies that adjust the "price" one must pay to engage in one behavior relative to another. Governmental regulations change "prices" individuals and organizations pay by increasing the dollar costs or other penalties for engaging in a particular behavior. Land use zoning, building codes, and related uses of the police power essentially induce behavior by making it harder or more time-consuming to do things contrary to an ordinance or statute. Seismic safety advocates have focused mainly on strengthening codes governing the construction of new buildings – with considerable success. They have had less success with getting policies enacted that require retrofit of existing structures and, then, maintaining those policies against an onslaught of efforts to repeal or modify them.

The second strategy for seismic advocates is to alter the criteria and/or priorities of individual decision makers concerning what, if anything, to do about seismic safety. The individual person or corporation decides whether to attempt to change government policies with respect to uses permitted on a specific site, whether to build or to occupy a given structure on a given site, and whether to build or retrofit a structure over and above minimum earthquake safety levels imposed by government. Consequently, the prudent advocate is concerned with both public adoption of seismic safety policies and programs, and with helping to ensure that individuals or organizations deciding on investing in or occupying a specific structure is, at the very least, willing to comply with the public policies and, perhaps, to want to go above and beyond those standards. Policies that are adopted, but not implemented, do not do much to enhance seismic safety.

THREE IMPORTANT QUESTIONS

Before focusing on the specific steps leading to improved seismic safety, prudent advocates should ask and answer three basic questions: What Is It We Want To Accomplish, Whose Attention Is Needed, How Can the Advocate Gain The Attention of the Target Audience?

What Is It We Want To Accomplish?

Petak and Atkisson (1982) describe ten kinds of hazard-related public policies, nine of which can, if appropriately formulated, enhance seismic safety. Excluded are disaster recovery policies except to the extent that they embrace one of the remaining nine policy types to reduce losses from subsequent events. All too often, advocates embark on efforts to gain the attention of policy and decision makers with the intent of having Action-Forcing and Regulatory Policy created without considering other options available to them. Advocates who hope to affect public policy should determine which of the nine policy types, if enacted, would help to achieve their specific objectives.

Policy Type	Description
Action-forcing	Adopted by higher-level jurisdictions and intended to force loss-reducing activities by lower level jurisdictions.
Attention-focusing	Intended to stimulate citizen, group, and governmental interest in hazard losses and to promote voluntary action to reduce such losses.
Disaster recovery	Intended to assist affected parties to recover from the losses.
Technology development	Focused on developing new knowledge and technology to support hazard mitigation policies.
Technology transfer	Focused on transferring knowledge to consumers, governments, and others and the use of that knowledge to reduce hazard losses
Regulatory	Regulate decisions and behaviors of private parties and governments to reduce losses associated with exposure to natural hazards: avoidance, building strengthening, site preparation, etc.
Investment and cost allocation	Specify conditions for governments' acquisition and allocation of resources to sustain other policies: how much will be spent, how, where, for what purpose, and at whose expense.
System management	Intended to fix responsibilities, specify means used, and define restrictions to be employed by hazard reduction programs.
System optimization	Intended to ensure that other policies are effective, compatible with system goals, and internally consistent.
Direct action	Authorize direct governmental action to implement a policy, such as physical construction or removal of structures.

Source: Petak and Atkisson. 1982. *Natural Hazard Risk Assessment and Public Policy: Anticipating the Unexpected.* New York: Springer-Verlag, Pg.61.

Table 1. Types of Hazard Related Public Policies

Whose Attention Is Needed?

Whose attention is needed is a function of what it is that the advocate wants to accomplish. Four target groups have been identified, each of which may be appropriate, depending on the advocate's objectives: rule makers, hands-on implementors, market intermediaries, and citizens at risk.

Rule Makers and Those Who Assist Them. Rule makers are public legislative, administrative, and judicial officials who authoritatively determine public policy at all levels of government. The advocate may choose to focus at the Federal level, attempting to gain the attention of members of Congress or staff in specific organizations in the executive branch, such as FEMA, HUD, or the GSA. Or, advocates might focus on gaining attention of legislators or agencies in specific states or localities. The attention-gaining focus needs to be on the places where action is needed to achieve the advocates' ends.

Included in the rule maker category are the quasi-public organizations that exist primarily to assist authoritative, governmental rule makers. These are quasi-public groups, such as the International Conference of Building Officials (ICBO), that are institutionally integrated into policy making processes. The ICBO develops model-building codes that are routinely adopted by states and municipalities. These institutionalized organizations have enormous influence on public policy.

Hands-on Implementors. Hands-on implementors include: builders, owners, and occupants, building officials, and members of the design professions. Sometimes, new public policies are adequate and what is needed is for those who actually implement policy are the appropriate targets of attention-getting efforts. It may be the case that a small cadre of advanced structural engineers want to help ensure that some specific "best practice" is applied more widely in the profession. Or, a new methodology may exist to enable building officials in smaller jurisdictions to apply more sophisticated analyses to proposed construction. Or, some advocate group may want to advise building owners and occupants of a newly detected threat. In each of these instances, a subset of hands-on implementors is an appropriate target.

Market Intermediaries. Lenders, insurers, and real estate professionals are the appropriate focus of some attention-getting strategies. These market intermediaries have enormous leverage to ensure enhanced seismic safety by conditioning loans, insurance, and property representation on a wide variety of seismic safety elements. If lenders require certain classes of buildings to meet enhanced seismic design standards as a condition of the loan, then seismic safety for that class of buildings is likely to be improved.

General Citizenry at Risk. Seismic safety advocates in agencies with specific missions to inform the public about hazards, exposure and protection are likely to focus attention-getting efforts at the general public at risk. Some messages to the general public, however, are particularly appropriate and may have the desired outcomes for at least a part of the target population. People now generally know how to protect themselves during a moderate event. Our research found that a small, but not insignificant, number of people reduced their losses in the Northridge Earthquake by having completed simple, inexpensive, and voluntary risk reduction measures before the temblor occurred (Alesch, Holly, Mittler, and Nagy 2001).

How Can the Advocate Gain The Attention of the Target Audience?

The question of how the advocate can gain the attention of a target audience is, of course, the most challenging of the three questions that must be answered before embarking on an attention-gaining effort. To help answer these questions, the discussion will focus on some basic concepts and constructs from organizational decision making, look at some historical efforts by advocates, and then draw some inferences intended to help the advocate.

BASIC CONSTRUCTS

This discussion is based on the premise that the attention of relevant decision makers can best be obtained by communicating to them within their frame of reference. That is, when attempting to gain the attention of those who can authoritatively make decisions about taking action to mitigate the effects of earthquakes, one is best served by putting that decision in a context that resonates with the decision makers' existing, fundamental interests, constraints and concerns. This is a fundamental concept. Yet, it is often overlooked by zealous advocates who believe that they alone know the truth and all that remains for them to save humankind is to bring that truth to the attention of others so they will see the light and act. It is critically important to understand the perspective of the decision maker and to frame issues in a context relevant to him or her.

Before attempting to gain the attention of policy and decision makers with the intent of getting them to enact a policy or make a decision on a matter, it is imperative to understand the conditions that must exist before they are in a position to do what is desired. Formal organizations of consequence have at least one thing in common: they all have more to do than time or resources will permit. The initial challenge for the advocate is to bring forward policy proposals that are sufficiently salient to the targeted decision makers and that the proposal makes its way onto an already crowded agenda.

ABOUT ORGANIZATIONAL DECISION MAKING

Two fundamentally different sets of theory exist concerning organizational decision making. The older of the two is prescriptive theory. It outlines, from the viewpoint of the "prescriber," how decisions *should* be made. The other body of theory is descriptive or behavioral. It describes how decisions *are actually made* in legislatures, boardrooms, and other formal organizations. The prudent advocate will pay much more attention to the latter than the former.

All decisions are made based on some criteria. In religious or faith-based communities, the dominant criterion is likely to be what the members perceive to be God's will. For them, other criteria pale in comparison. For engineers and economists, the dominant criterion is typically economic efficiency. Hence, engineers and economists usually try to communicate the worth of policies, programs, and projects in terms of benefit-cost ratios. Imagine a consulting engineer recommending a project with a high benefit-cost ratio to a faith-based community that believes it is God's will to take on another project without benefit of a benefit-cost analysis. Both have applied their relevant criteria, both are rationale, and, yet, the consulting engineer is likely to be completely dumbfounded by the group's choice. In this discussion, we work from the premise that the advocate must address the target decision maker from the perspective of the decision maker as a "customer" and in the customer's frame of reference. It may be that the advocate can alter that decision maker's frame of reference, but one cannot count on it.

A descriptive theory of organizational decision making that we have found particularly useful is called the garbage can theory. Originally constructed by March and Olsen (1976) and later elaborated by Kingdon (1984), the garbage can theory can be summarized fairly briefly and simply.

Fundamentally, the theory states that four independent "streams" must be in place before an organization makes a decision about an issue. First, a critical mass of decision makers must believe a problem exists. Moreover, that cluster of decision makers must agree on what the problem is. Second, the decision makers must believe that a workable solution to the problem exists and that they know what that solution is. Third, there must exist at least one persistent advocate for the solution who has access to the decision makers or who is one of them. This advocate must be able to keep the issue on a front burner. Finally, space must exist on the decision makers' agenda for this issue to be acted upon. If any of the four streams is not brought into conjunction with the other three, no action will be taken.

Two other aspects of the theory are particularly relevant to this discussion. First, problems come in different levels of complexity and tractability. Some are simple, easily recognized for what they are, and have relatively few ramifications and entanglements with other matters. Others are not easily defined, messy, highly controversial, and have ramifications that go well beyond immediate concerns. These are "tar baby" issues and problems that can easily mire decision makers in inescapable dilemmas. The garbage can theory likens these two kinds of issues to your desktop, which, in this case, is a garbage can. In the array of issues and problems, each of us is likely to reach for the easy, shiny issues – those that can be easily identified and dealt with. We shun the issues that look complex and for which there tends to be no easily identifiable solution. What are they and what am I supposed to do with them now? It is much easier and more rewarding to fund a new Federal District Courthouse than it is to address fundamental issues like abortion rights and cloning stem cells.

Finally, the garbage can theory tells us that organizations have several ways to process issues and problems without really dealing with them substantively. One way to deal with an issue is "flight." This coping mechanism means that the decision makers choose not to deal with the matter in hopes that it will go away or that they will be gone by the time it has to be dealt with. The California legislators now being pressed to deal with problems emerging from enforcement of the policy the legislature enacted concerning retrofit or replacement of pre-1973 hospitals will not be in office "when push comes to shove" in a few years. Term limits in California ensure they will not be there, so why not push the issue off and deal with issues that are more fun and/or more imminent?

A second coping mechanism is "oversight." "If a choice is activated when problems are attached to other choices and if there is energy available to make the new choice quickly, it will be made without any attention to existing problems and with minimum time and energy" (March and Olsen, 1976, p. 32). This decision style helps one to understand why the California Legislature adopted a policy to decrease the ratio of nurses to patients in hospitals from six to one to four to one even though not enough nurses exist in the state to meet those requirements and even though it will cause hospitals already in dire financial circumstances further economic hardships, probably resulting in diminished hospital capacity.

The third decision style described by March and Olsen is "resolution." Cynics might say, "Well, if all else fails, it may be necessary to actually address the fundamental issue." Some organizations are much better at studying issues, developing workable solutions, and adopting appropriate policies than others. Of course, there must still exist an agreed upon problem, an agreed upon solution, at least one advocate, and agenda space.

We like to add one additional decision style to the garbage can theory. We call it "transformation." If one doesn't quite know how to deal with a problem, perhaps it can be transformed into something else. Sometimes this is conscious. One is sometimes amused, sometimes distressed, by how often the U. S. Supreme Court, when faced with a particularly difficult case involving truly ugly choices, finds a way to remand the case to a lower court on a technicality. Sometimes, transformation is not a conscious act. Most of us employ transformation when faced with choice situations in which the problem is novel or not readily recognizable. In such cases, we frequently recall what we think are analogous phenomena, but which are not, and "morph" the current situation into one that is recognizable to us and with which we think we can deal. Consequently, we end up working earnestly to solve the wrong problem.

In addition to the garbage can theory, it is important to remember that not everyone gets excited about, interested in, or active in every, or even, in most issues. Individual policy makers and organizational decision makers tend to focus their efforts in certain spheres of issues and problems. In legislative bodies, legislators typically give deference to other legislators who focus in a specific sphere, voting for their policy recommendations or, depending on the circumstances, as their political party dictates. In return, they expect deference in their areas of interest and expertise. Political scientists refer to spheres of interest and influence and talk about spheres of mutual nonintervention to describe this kind of behavior. Often, policy elites develop within these spheres of mutual nonintervention and have significant impacts on what happens. In California, for example, Senator Alfred Ahlquist, until term limits ended his career, was widely recognized as the dominant legislative force on earthquake policy.

Addressing the issue associated with the need to gain acceptance by multiple organizations, Lober (1997), building on the work by Kingdon, suggests that the complexity created by the need to address multiple organizations or stakeholders requires an approach that allows for collaboration in the agenda setting process. That is, in the context of the "garbage can" model, adding and facilitating an organizational collaboration stream is to help increase the understanding of organizations and stakeholders about their collective risks in order to increase their willingness to develop and accept improved approaches to addressing the problem through informed decision making.

PREREQUISITES FOR ADOPTION, DESIGN, AND IMPLEMENTATION

Notwithstanding the previous discussion, we believe four fundamental prerequisites must be met before decision makers will adopt a policy, design a program embodying that policy, or implement a program. First, a critical mass of decision makers must perceive that a risk exists and that it is potentially harmful to interests they value. Second, those decision makers must believe that action can be taken that will reduce the adverse direct or indirect effects of the hazard. Third, the decision makers must perceive that taking action now is in their best interests or the best interests of their constituents. Fourth, there has to be an absence of significant opposition to the proposed policy or program. These four prerequisites should condition the "gaining attention" step for the seismic safety advocate.

Prerequisite 1. Decision Makers Must Perceive a Significant Risk and a Significant Likelihood of Serious Adverse Consequences

It is well understood that not much innovation occurs unless someone experiences or expects physical, financial, or emotional discontent and decides they want things to be better. In more abstract terms, problems exist for organizations only when there is a disparity between what the organization's policy makers desire and expect, and their perception of the state of affairs they believe exists or expect to exist within some relevant time frame. There has to be a disparity between the desired and perceived reality. Consequently, one should not expect legislators or organizational decision makers to adopt or implement risk reduction behaviors unless a critical mass of decision makers in that entity is dissatisfied with their perception of the current or projected state of affairs and, consequently, decides that a problem exists.

In the traditional model of risk assessment, we look at the hazard, exposure, vulnerability, and probable losses from events of various magnitudes. For policy makers to perceive themselves as having an earthquake problem, a critical mass of authoritative decision makers must understand and accept that a credible earthquake hazard exists, that it is likely to occur within a relevant time frame, and that, should it occur, the organization or its constituents will suffer significant losses. Therefore, the prudent advocate from outside the organization should be concerned with how organizations define the earthquake problem — how they perceive the risks they face in terms of exposure to the hazard, vulnerability, and the losses that are likely to result from an earthquake. We cannot expect target organizations to take action unless they know the hazard exists and can relate that hazard to potential adverse effects for themselves or their organization.

Most involved professionals understand earthquakes reasonably well, but every earthquake of consequence teaches things we didn't know before. If those who study the phenomenon continue to be surprised at what is learned from each earthquake, what about the lay person who only thinks about earthquakes when big ones occur or when they watch some inaccurate and misleading motion picture or presentation depicting one? For decision makers to take appropriate action, they must internalize information about the hazard that is relatively simple to understand, consistent over time, and is meaningful to them. Recent research conducted in connection with communicating performance based seismic design tells us that expected annual losses, for example, has neither meaning nor relevance to most organizational decision makers. Nor does benefit-cost analysis. Decision makers generally employ other, entirely rational criteria for making their investment decisions.

A second key element in risk perception and problem definition has to do with timing. Obviously, seismologists are still unable to predict earthquakes except over spans of tens and hundreds of years. Lay people have a hard time understanding return periods and understanding that the experts don't know the location of all the faults that might generate earthquakes. We have to learn how to say, large earthquakes are not low probability events; the probability of occurrence is nearly one. They are, however, rare in any given decade. That means the chances of one occurring in your neighborhood this year is quite slim. You can bet the farm, however, that, one of these days, one will occur right where you are standing. Now, how lucky do you feel?

We have all had the experience of hearing someone say, "Thank God, I survived the hundred-year flood. I'm safe for another 99 years," or "We haven't had an earthquake here since 1812. It's just not going to happen in my lifetime." Even if one accepts the inevitability of a damaging earthquake, if the threat is not perceived as likely within one's relevant time frame, the salience of the risk is minimal because the individual or organization does not perceive a risk that justifies action.

And we've heard people say, "I live more than 10 miles from the San Andreas fault; we're safe from earthquakes here," even though California's most recent damaging earthquakes occurred on unmapped faults. In recent field research on flood hazards in the Tar River, North Carolina, one of the authors heard business owners sitting amidst ruined inventory and massive financial losses, teetering on the edge of ruin, say, "I didn't think I needed flood insurance. I'm in the 500-year flood plain." If individuals and organizations believe the event will not occur where they are, or damage them, they do not perceive a risk.

Professionals in the hazards business find it hard to believe that there are organizations in California and other dangerous places who do not understand the inevitability of medium and large earthquakes and the consequences for life and property. The professionals have a tendency to believe they underestimate the risks to which they are exposed, and many of them believe the professionals continually overestimate the risks, mainly to their benefit.

It is also the case that not as much is known about the risks as we would like to know. We are still learning about the nature of the hazard, including the characteristics and expected magnitudes of ground motion and structural response. Even among the professionals, disseminating new knowledge takes time; communicating new knowledge about the earthquake hazard to people who may or may not be interested in that information takes much more time. And, it is difficult to communicate risks in ways that people can understand it. Hence, as we learn more, the challenges are moving information more quickly and accurately from the science community to the lay community when the communication channels are already jam-packed. In short, a lot more effort is needed in determining out how to communicate the earthquake risk, especially in areas where events are rare.

It is not enough for policy makers to buy into the likelihood of a moderate to large earthquake. If you expect those policy makers to take actions to protect themselves or their constituents, they have to believe that there is exposure, vulnerability, and the likelihood of adverse consequences when the event occurs. There must be an expectation of significant loss.

Knowing that there will be damage from an earthquake is not the same as expecting adverse consequences from it. When asked "Why did you have earthquake insurance on your business?" a small businessman in the Northridge area responded matter-of-factly, "I couldn't get the SBA loan without it". When asked "Why *didn't* you have earthquake insurance on your home?" (knowing that his house had been red-tagged following the event). He stated just as matter-of-factly, "We thought the government would pay for our losses; we were wrong."

Expectations of loss also depend on how much one has to lose. If your business is just hanging on and you do not have a lot to lose, then your definition of the problem is altered. "What, me worry?" Or, perhaps you just feel lucky; "I've been doing business here for 35 years and nothing has happened yet." Or you may feel protected by one or another deity. Or, perhaps your internal calculus concerning the joint probability of occurrence, imminence, proximity, intensity, and consequent damage, just says to you that this is not something you have to be concerned with.

Prerequisite 2. Decision Makers Must Believe Something Can Be Done to Reduce the Risk

Assuming that a critical mass of policy makers in the legislative body or other organization perceives the earthquake risk and attendant problems, they will take precautions against the hazard only if they believe they can do something to reduce the risks. There must be a perception that there is an acceptable solution to the problem or nothing will be done. A number of obstacles can exist that would keep an organization's policy makers from believing they can take action.

The Policy Makers' Mind Set. A fatalistic attitude is perhaps the most difficult obstacle to overcome when trying to stimulate risk-reducing behavior: "If it's going to happen, it's going to happen. It's God's will and there's nothing I can do about it." Some people have strong feelings of an external locus of control, while others believe in their own efficacy – which they are confident they can do something to alter what is otherwise likely to happen in the future.

A Slim or Unknown Inventory of Acceptable Risk Reducing Actions. A solution isn't a solution unless decision makers know it exists and believe that it will be effective within their social, political, and organizational context. There are several perfectly valid reasons decision makers might not be aware of workable solutions. First, a solution may not yet exist. We do not know, for example, how to immunize people against the AIDS virus. New seismic safety problems, like broken steel welds, continue to surface, often as side effects of employing new technologies. It took quite a while to come up with means to strengthen unreinforced masonry buildings that owners believed would be cost-effective.

Second, the actual inventory of workable solutions may be slim. For example, those old enough to be doing business before xerographic copying machines remember how we had to choose between carbon paper and wet process copiers. Innovative ways to deal with the need to create multiple copies were developed, but, at first, they were too expensive for all but the most affluent organizations to afford. As costs dropped, more organizations were able to adopt the innovation. Now, many of us have sophisticated copying machines in our homes for personal use.

Third, despite the Internet, disseminating innovations still takes time. Dissemination especially takes time when the innovation has been developed as proprietary property by a firm not in the business of selling its mitigation techniques. Even when solutions are not secret, there are obstacles to innovation dissemination and technology transfer.

Intractable Problems. Some problems are perceived by organizations as intractable and, when that happens, organizations sometimes simply stop seeking to understand them, much less continue efforts to find a solution to them. One can imagine hearing, "We can never build a structure to withstand an earthquake of X magnitude." or "I believe planet Earth will someday collide with an asteroid or space object of great mass, but nothing can be done about it," or "Global warming is inevitable and, with it, great dislocation and difficulty, but, since nothing can be done, we are just along for the ride."

Intractability, of course, varies from time to time and place to place. Intractability often has less to do with complexity than it has with being locked into a perceptual paradigm that keeps one from seeing familiar things in new ways. The new ways of seeing things often evolve into new obvious a solutions to situations that were otherwise enigmas. What is intractable to some is not to others. Moreover, intractability changes to tractability with changes in the social, legal, or organizational environmental. Sometimes it changes with the availability of new technologies. And, sometimes it changes when looked at by someone with a new or novel perspective. In any event, as long as an organization perceives a problem as intractable, little can be done to move it toward implementing a solution.

Prerequisite 3. Policy Makers must See That Taking Action Now Is in Their Best Interests

Almost half a century ago, March and Simon created a simple, yet robust model of organizational decision making to explain a set of choices (March and Simon, 1993)**.** The model suggests that organizations seek alternatives to what they are doing when they are dissatisfied with the way things are going. They keep searching as long as they believe there is a decent solution that can be found for less than the cost of the search, until they find an acceptable alternative, or until they conclude they cannot do better than they are doing now. Organizations take action when a critical mass of decision makers believes either they or the organization or system for which they are responsible will be better off taking the action now than either deferring or not taking any action.

An 85-year-old woman testified before a Committee of the Los Angeles City Council that was deliberating about the city's proposed un-reinforced masonry building retrofit ordinance. "Let me understand this," she said. "You want to increase my rent by $50 a month for sure, forcing me to choose between medicine and food, because there might be an earthquake that might damage my building and I might be injured. Are you gentlemen playing with all your marbles?"(Alesch and Petak, 1986).

Frankly, this woman put her finger squarely on a critical issue. Everyone has more ways to use resources than he or she has resources. When given a choice of how to use those resources, most people are generally rational. That is, given their preferences and their perception of the probable payoffs from alternative courses of action to realize those preferences, they will, for the most part, spend appropriately. Some people and organizations are better than others in making good choices. Anheuser-Busch assessed the risks to its business in southern California and decided it made good sense to strengthen parts of its brewing process against earthquakes. The precautionary project was completed only about six months before the Northridge Earthquake. Prudent or lucky?

A significant obstacle to communication between seismic safety advocates and those who are in a position to make policy that would reduce seismic risk has to do with the definition of what constitutes rational behavior. Most people simply assume that everyone is rational to the same set of values. That is, most assuredly, not the case. Just as each of us has a different level of tolerance for ambiguity or a different level of risk aversion, each of us has his or her unique mix of values. Notwithstanding the complexities of perception and motivation, each of us generally attempts to make decisions that are rational with respect to our unique value base. Lasswell (1976) argues, for example, that, while you may be rational to the value base called "seismic safety," elected officials are likely to be rational to the value base "power." Consequently, what you may see as entirely rational may be wholly irrational to the elected official. Neither of you are wrong; you simply have different criteria for interpreting the situation and making a decision.

Public policy makers tend to concern themselves with aggregate measures of well being. They care about events in which lots of buildings are damaged and the public has to bear great costs. One advantage seismic safety advocates have in gaining legislative attention and action is that legislatures, because of their composition and organizational structure, are rarely comprehensive in their overview, tackling one issue at a time without much regard to how one issue affects another. In California, one legislature enacted SB1953 requiring all hospitals built before 1973 to meet contemporary earthquake safety levels by 2008 and 2030. Despite the extraordinarily high costs of complying with this safety measure, with full knowledge that about three-fourths of California hospitals are in dire financial condition, and with probable knowledge that not enough nurses exist in the state to meet the requirements, a subsequent legislature enacted a new standard requiring a 50 percent increase in the number of nurses per patient in hospitals. As a consequence, it is possible that the number of hospital beds in California will be reduced as hospitals are forced to reduce service or to close in the next few years. Legislatures sometime adopt policies that are counterproductive with respect to one another**.** This is, unfortunately, rational from the perspective of legislators who value remaining in power more than they value either consistency or systemic consequences.

Implementation problems for public policy occur when governments enact policies dictating that some specific risk reduction measures be taken by a class of organizations regardless of the value base those individual organizations have concerning risk and potential payoffs. Public policy makers are less likely to concern themselves with the judgments made by individual firms concerning the marginal utility of a dollar spent to reduce the earthquake risk to the firm compared with the marginal utility of a dollar spent elsewhere. Often, businesses have different uses for money on matters of higher priority and more urgent concern. Governmental policy makers will not adopt policy that does not meet their tests of rationality, but often adopt policies that do not meet the rationality tests of individual organizations. Organizations will resist implementing those policies if their own estimates of the risks, payoffs, and relative priorities do not coincide with those of the governmental policy makers.

Prerequisite 4. Policy Makers Must Perceive There are No Major Obstacles or Opposition to Adopting the Proposed Risk Reduction Measures

Competition for Attention and Resources. Assuming the key decision makers are aware of the earthquake threat, know there are measures they can take to reduce their risks substantially, and are convinced that it makes sense, they may still not adopt policies directing that risk reduction measures are implemented. In the competition of issues and ideas for time, reducing natural hazard risks may not reach the top of the agenda. Other issues may continually crowd it off, because the organization lacks the capacity to do what it perceives necessary, or because the organizational environment responsible for implementation is itself dysfunctional.

One might expect, for example, the California legislature to provide some financial assistance to hospitals so they can implement the seismic safety policy the legislature enacted. Alas, events in one issue area often have implications for others. In this case, California's 2001-02 energy crises and the accompanying recession resulted in massive state budgetary deficits. Providing financial help to struggling California hospitals was deemed simply out of the question by the governor and the legislature; it never really got on the agenda for consideration.

"It's important, but we just have too much on our plate right now." How often have you heard or said that in the context of a formal organization faced with an array of important, urgent, and involved initiatives? Like individuals, organizations have to set priorities and must address issues based on some criteria concerning what comes first. Often, unfortunately, tactical concerns often take time that would be better spent on strategic assessment, so risks from hazards perceived as having relatively low likelihood are pressed onto the back burner so the current emergency can be dealt with. Organizations with more resources are generally better able to devote resources to both today's problems and tomorrow's vision.

Hostile or Supportive Environments. A policy is more likely to be adopted if the several organizations and interests affected by the policy are supportive or, at least, neutral concerning the policy. If some stakeholders are openly hostile toward the policy and its goals, the policy is unlikely to be adopted or, if adopted will be caught up in a continuing struggle to have it repealed. Policies are more likely to be implemented if they are "actively supported by organized constituency groups and by a few key legislators (or the chief executive) throughout" (Sabatier and Mazmanian, 1979).

In the case of California's hospital retrofitting statute (SB1953), hospitals supported passage of the initial legislation. At the time, another similar bill, although much more Draconian from the view of the hospitals, was being proposed. The economics of health care finances had not yet started its wild transformation and most hospitals were still generating operating surpluses, or at least breaking even. The earthquake engineering community strongly supported the bill. There was relatively little opposition, the expected financial impacts on hospitals were a long way off, and the bill passed. Now that the legislation is having adverse consequences for hospitals and health care organizations, the battle to change the legislation has been joined, but the stakeholders have disparate views of what should be done. Labor unions representing hospital workers maintain that they do not want their workers in unsafe facilities, so the legislation should be fully implemented. Hospitals and health care organizations are not agreed on what should be done; the health care organizations are diverse, and since the retrofit or replacement burden falls unequally among them, their interests are diverse and often in conflict with one another. The state agency charged with administering the legislation supports the existing policy, program, and administrative rules. The structural engineering community itself is divided concerning the program devised to implement the policy and the way it is being implemented by the state. The great diversity of viewpoints on the part of the stakeholders means the legislature is unlikely to make any significant changes in the legislation until a critical mass of stakeholders comes to the legislature with a "fix" that is generally acceptable to each of them.

LESSONS FROM SEISMIC SAFETY ADVOCACY EXPERIENCES

Advocates of seismic safety have had some major successes and some significant failures in gaining the attention of policy makers and having that attention result in policies that have enhanced seismic safety. The most significant successes have come in California and a few other states in which there has been seismic activity. The successes have been primarily in increasing the standards for the construction of new buildings and in building and retrofitting publicly owned infrastructure, particularly transportation links and lifelines.

Seismic advocates have been successful, typically after long struggles, in having legislation passed requiring that older buildings be retrofitted to meet standards more closely approximating those in current building codes, but only in California. Even so, the retrofit statutes and ordinances have been difficult to maintain. Retrofit and structural replacement statutes and ordinances frequently face efforts to water them down or eliminate them altogether. California's much-heralded Field Act (1933) requiring that schools be made stronger against earthquakes was threatened by significant efforts to repeal it and, many decades later, unreinforced school buildings remained in use (Geschwind, 2001). The pioneering ordinance in Long Beach to require retrofit or demolition of unreinforced masonry buildings faced continual opposition for years, as did the Los Angeles' unreinforced masonry retrofit ordinance, not enacted until half a century after the 1933 Long Beach earthquake (Alesch and Petak, 1986).

Seismic advocates have not been notably successful in prompting private volunteer action by individuals and firms to reduce their exposure and vulnerability to earthquakes, although a few notable success stories have circulated widely. Outside the states with the most frequent seismic activity, little has been achieved.

All of this tells us that seismic safety is not an easy sell in areas where earthquakes are infrequent and when investors are required to retrofit existing buildings. The saliency of earthquake risks is generally low and the messages that work in California simply may not be relevant in other places and in different contexts (Drabeck, Mushkatel, and Kilijanek, 1983, pp. 14-15). Part of the problem may be that the various persons and groups that might advocate for seismic safety do not necessarily share the same set of values as one another or as others who may attempt to gain the attention of policy makers with conflicting messages. Enhancing seismic safety is often seen as paternalism, limitations on personal freedom, a "taking", or any of a host of other concerns (Godschalk, et al, 1999, pp. 495, ff.).

Damaging earthquakes, particularly in the United States, make policy makers more receptive to messages about the need to enhance seismic safety, but only for a relatively short time. Most, but certainly not all, earthquake legislation is enacted in the aftermath of a damaging earthquake. Windows of opportunity opened by earthquake events make it easier to gain attention, but they do not stay open very long, especially if other urgent and important issues bubble up. Nor do the windows of opportunity guarantee that good policy will be made; usually they simply guarantee that some policy will be made. Although California's SB 1953 (hospital retrofit statute) was enacted following the Northridge event which caused damage to hospitals, the approach embodied in the law had been under consideration by the California Seismic Safety Commission and others for a considerable period of time. Clearly, when seismic advocates are able to work from organizations with built-in access to policy-making bodies, they are extremely effective in conveying their message to key decision makers. Unfortunately, they have not been as skillful at recommending and getting passed legislation that has good staying power, except in the areas of codes regulating new construction.

CONCLUSIONS: GUIDELINES FOR ADVOCATES

Be Salient

Extreme natural hazard events are, by definition, rare. Making people and policy makers aware that moderate and large earthquakes are likely during the next fifty years is not particularly difficult. Getting them to internalize the fact that such an event could happen any given day and that not taking precautions is likely to result in massive downside consequences is much tougher. It is thus essential to communicate the risks to policy and decision makers within their frame of reference, not within yours.

To a considerable extent, communicating the risk and the need to take appropriate actions is a problem in decision framing. While engineers are taught to think in terms of benefit-cost and expected annual losses, those criteria have relatively little meaning to most policy makers, not because they are uniformed, but because they are responsible for making choices based on multiple criteria, not simple economic efficiency. Prudent advocates will learn the language and the decision context of those with whom they are trying to communicate.

Prudent advocates will also seek allies with related concerns and with whom they can collaborate to work together to establish communication links with decision makers and with other allies. The risk communication message must resonate with both the allies and with the communication targets.

Be prepared to use windows of opportunity to communicate your seismic safety message, because those windows open without warning and then slide shut days or weeks later. However, do not count on a window opening for you. Most likely, you will have to work hard to find advocates within the organization or institution to help plead you case and to keep it on the agenda of already overburdened policy and decision makers.

Be Credible

A very successful Secretary of a state agency who wishes to remain anonymous once told one of the authors of this discussion paper, ". . . is a very complicated policy issue. For us to develop a good policy -- one that will work and is fair -- will require that we isolate the extremists on both sides of the issue and make them irrelevant." The seismic safety advocate cannot sound like an extremist, wanting the public to buy much more safety than it can possibly afford at this time. To do so invites the opposition (and there will be some) to suggest that the proposed policy is too much like a full-employment act for structural engineers or some other advocate group. The messages and the stance should be such that it is not viewed as self-serving.

Credibility requires establishing alternatives and priorities. Too many people in America are out of work, homeless, without health insurance, hungry, and ill housed for the nation or any state to buy the highest levels of seismic safety for all buildings, new and existing. To be credible in the face of important competing demands requires that the advocates acknowledge priorities and speak to how much safety can be bought and with how much money. Certainly, in the Midwest and East, where strong earthquakes will occur, but at perhaps not for a century or more, seismic safety standards might be acceptable for high occupancy buildings for the maximum event expected over the next century. Collapse prevention standards for high occupancy, new construction might be acceptable to a critical mass of decision makers in areas with infrequent events.

In short, advocates for seismic safety should try to avoid being seen or characterized as "safety zealots" and more like credible, knowledgeable, and helpful advocates for what is good for the community. This, of course, requires substantial humility and full comprehension by the advocate that he or she does not, alone, hold the "secret to salvation"

Be Persistent

Advocates should work to find and cultivate allies in bureaucracies, legislatures, and stakeholder groups, such as property and casualty insurers. The allies will be people who have some kind of stake in helping to ensure enhanced seismic safety or the benefits that follow. Struggling to develop and nurture contacts and allies is not something one does once in a while. It requires considerable time and energy over a long time.

Persistence is also important in developing built-in institutional access, like statutory participation in building code advisory bodies, environmental impact analysis requirements, site analysis for structures, utilities and lifeline infrastructure governing bodies, and the like. A long-term goal of the advocate should be to have the possibilities of seismic activity automatically brought into investment decisions in public and private infrastructure.

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Guidance for Seismic Safety Advocates: Communicating Risk to the Public and Other Stakeholders

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Introduction

This element in the Tricenter Project is based on the assumption that seismic safety advocates have a better chance of realizing their objectives–persuading the public that enhanced safety measures are needed, turning apathy and even outright opposition into support for earthquake safety, and building a constituency that will support loss-reduction measures–if they convey information in ways that are consistent with sound risk communication principles. While risk communication alone is not sufficient to bring about change in individual, group, and organizational behavior, effective risk communication is an essential element in that process. Beyond communicating risk, however, advocates must also build constituencies that support seismic safety and take other steps to realize their objectives in public policy arenas. Strategies for building that support are discussed at length in other papers in this volume. This paper provides guidance that will enable advocates to craft effective risk communication messages and campaigns, deal with issues that are unique to earthquake risk communication, and avoid mistakes that can undermine efforts to enhance seismic safety.

Risk Communication Research and the Earthquake Threat

Background: Taking Advantage of a Large Body of Knowledge

The literature on risk communication is large and diverse. Various disciplines, including psychology, cognitive science, communication and mass media studies, sociology, management science, decision sciences, and various health-related disciplines, have made contributions to the body of work that currently exists on risk communication. Studies vary along many dimensions, including:

- The types of risks that are focused on, which span a vast panoply of health, safety, and environmental risks–including natural and technological hazards
- Salient characteristics associated with risks, including their frequency and severity, uncertainty with respect to the risks themselves and to outcomes resulting from their occurrence, and other attributes of risks (e.g., familiar, exotic, dreaded or deadly)
- Risk communication time frames, which range from very short-term (e.g., warnings that some disaster will strike within minutes or hours) to long-term (e.g., risk communications focusing on the long-term health risks associated with smoking or poor diet)

- Elements in the risk communication process that are considered (e.g., source, message, channel, and receiver characteristics and combinations of those elements)
- Models used to describe and explain the risk communication process
- Factors associated with risk communication successes and failures
- Dependent variables and outcomes of interest, which range from risk perceptions and changes in those perceptions to specific actions that can be taken in response to risk communication messages, such as self-protective and risk-management activities

Within this very large literature, there are a variety of publications that attempt to distill general lessons learned from risk communication research and practice. Some of these publications focus on natural hazards. Examples of relevant work include: National Research Council, 1989; Handmer and Rowsell, 1990; Kasperson and Stallen, 1991; Sublet, Covello, and Tinker, 1996; Lundgren and McMakin, 1998; and Morgan, 2002. While the literature on risk communication involving natural hazards includes studies on hazards of all types, a significant proportion of that work addresses earthquakes (see, for example, Mileti, Fitzpatrick, and Farhar, 1990; Mileti and Fitzpatrick, 1993; Mileti, Darlington, Fitzpatrick, and O'Brien, 1993; Blanchard-Boehm, 1998). Guidance can thus be drawn from a wide variety of sources, including the large literature on shorter-term disaster warnings (see Lindell and Perry, 1992), which also has potential relevance for earthquake risk communication.

The Challenge of Communicating About Earthquake Risks

Efforts to design effective risk communication messages and campaigns can draw upon general lessons from the broader risk communication literature, as well as portions of that literature that focus specifically on natural and technological hazards. However, in drawing upon those lessons, advocates must also take into account what is distinctive about the U. S. earthquake threat and the public response to that threat–factors that make devising risk communication strategies and stimulating action particularly challenging. In particular, the tasks advocates face are difficult because:

- Hazard contexts vary nationwide
- Risk communication contexts also vary in a variety of ways, e.g., situations in which considerable effort has already been invested in communicating earthquake risk versus those in which little has been done, and situations in which significant earthquakes have recently occurred versus those in which it is not possible to "capitalize" on recent events in risk communication efforts
- While not rare when considered on a national scale, earthquakes range from infrequent to very rare for individual communities, and highly damaging earthquakes remain very rare
- Regions, communities, groups, and individuals vary with respect to their earthquake experience
- All earthquake forecasts and loss projections involve significant uncertainties, and those uncertainties also vary on a regional basis

- Earthquakes are seen as a serious threat in only a few U. S. communities
- Public perceptions and knowledge of the earthquake threat vary on a community and regional basis
- Public perceptions and knowledge of the earthquake threat also vary as a function of such factors as socioeconomic status, ethnicity, and gender
- Even in areas where awareness is high, that awareness only rarely leads to action
- Views concerning the earthquake are colored by a variety of myths and subject to the same biases as those that accompany other hazard-related risk perceptions
- In general, the public is not well-informed, either with respect to the earthquake hazard or with respect to current and achievable levels of seismic safety–for example, how much safety current codes offer, what additional levels of safety can be achieved through stricter codes, and what benefits can be achieved through seismic retrofitting
- In many communities, lawmakers and other public officials–that is, those this project targets as potential advocates–may be no better informed than the general public on issues of seismic safety
- Earthquakes tend to be low on political agendas, except during periods immediately following significant disaster events
- Since the events of September 11, 2001, earthquakes and other natural hazards must increasingly compete with homeland-security-related threats for public attention and dollars

These aspects of the earthquake threat have several implications for how advocates should approach the challenge of communicating earthquake risks. One major set of concerns centers on ways of effectively targeting audiences. In many parts of the U.S. and in many segments of the public, the earthquake threat is not salient enough to generate either true concern or action. Thus, one overriding challenge is to provide information in ways that motivate people to take the threat seriously. Because many audiences are likely to be confused about the earthquake hazard, even in high-risk areas, risk communication messages must be informative, rich in educational content, and designed in ways that enhance learning and the retention of relatively complex information. Along these same lines, strategies must be customized in ways that address variations in hazard context and in earthquake experience. They must also be designed to take into account sociodemographic factors, such as community and regional variations in public perceptions and knowledge of earthquake threats, that influence the risk communication process.

A second set of challenges center on the nature of the earthquake hazard itself. For risk communication purposes, earthquakes can be classified as "low probability/high consequence" events, and risk communication strategies should be designed accordingly. Additionally, risk communication strategies must address and surmount problems associated with the communication of uncertainties. Finally, the approaches adopted for communicating earthquake risk and mobilizing public support strategies must be designed to overcome apathy and anticipate and neutralize organized opposition. The remainder of this section of the paper discusses these general considerations and suggests appropriate risk communication strategies.

Earthquake Risk Communication as Process

One major barrier to effective risk communication lies in the fact that scientists and engineers developed much of the knowledge that exists on the earthquake threat, and, as a result, available information on earthquakes and their impacts is often geared towards these professional groups. Geologists, seismologists, structural engineers, and other professionals conduct research and develop findings in order to communicate with one another, but generally not with community residents, public officials, or community groups. Their work is mainly carried out to advance professional knowledge and improve engineering practice rather than to motivate public concern or reshape public policy. There is thus a disconnect between existing scientific information on risks and the information needs of the public and stakeholder groups. All public risk communication efforts must identify ways of translating data that were originally developed for communication within the scientific community into information the public and decision makers can understand and use. Fortunately, the literature contains a considerable amount of sound guidance on how that can be done. What follows are some practical pointers that are based on that literature.

Addressing All Components of the Process

There are many models of the risk communication process, virtually all of which have their basis in Lasswell's (1948) original characterization of communications as involving six elements: source, channel, message, receiver, effect, and feedback. As summarized by Tierney, Lindell, and Perry (2001: 84-85), the process can be thought of as encompassing the following steps or stages:

> [I]nformation about an actual or potential disaster can come from physical cues or from social sources such as authorities, news media, and informal groups. The information can be transmitted face-to-face or through different technological channels (print or electronic) to different demographic segments of the community, producing a range of psychological and behavioral effects…the effects on the recipient take place in a sequence of stages, including exposure to the information, attention to it, comprehension of its meaning, and acceptance of its accuracy and relevance for the receiver.

Once received, the information produces both cognitive and affective responses among information recipients. Ideally, those information recipients then take some action, which in turn produces feedback and possible subsequent behavioral adjustment.

From the perspective of the individual who is the intended recipient of risk information, the risk communication process involves a series of stages, described by different researchers as hearing the information, understanding it, and perceiving its relevance (Nigg, 1982); attention, comprehension, acceptance, retention, and action (Lindell and Perry, 1992); and hearing, understanding, believing, and personalizing the risk (Mileti and Fitzpatrick, 1993). Nathe, et al. (1999) characterize the public education process for enhancing seismic safety as seeking to provide answers to the following questions for message recipients:

- What is an earthquake?
- What are the likely damages and losses from an earthquake event?
- Am I likely to suffer personal losses in my home or office?
- Can I do anything to reduce my vulnerability to seismic events?
- What will it cost to reduce my losses? How complicated is it? Has anybody I know done it? And when shall I begin?

Risk communication campaigns that are not able to provide answers for those questions are unlikely to succeed in gaining attention and motivating action. Effective efforts are those that help message recipients move through the entire process, from understanding the hazard to taking action to reduce their risks.

In developing and carrying out their risk communication strategies, advocates must think in terms of the entire risk communication process, taking into account all elements that are necessary for effective risk communication. Working through the stages of the general model of communications outlined above, ensuring that risk communication efforts have an impact involves selecting the best **sources** for the release of information; taking information **channels** into account, crafting appropriate **messages**, visuals, and other media for communicating risk; having an understanding of which message **recipients** are being targeted and what the needs and capabilities of those target audiences are; and specifying what **effects or actions** the message is intended to produce (for example, stimulating preparedness). The following sections provide further guidance with respect to the first four components of the risk communication process: (1) sources; (2) channels; (3) messages; and (4) recipients.

Information Sources

People receive information on hazards of all kinds from a wide range of sources, including informal sources such as friends, family members, co-workers, and neighbors; mass media outlets; new communications media, such as the Internet; the scientific community; government sources; private-sector sources, including corporations and advertising; and their own personal experiences. At any given time, individuals and groups may be actively involved in seeking out hazard-related information, or they may merely passively receive that information in the course of their everyday activities. Information obtained from the media and other "impersonal" sources is confirmed, reinforced, or revised through informal contacts and conversations. The reverse is also true: when people obtain information through their informal ties, they may seek verification or additional information through formal channels. These various formal and informal sources may convey erroneous as well as accurate information, and the information obtained may be consistent or inconsistent. Various information sources may contradict one another, and information that is disseminated through formal channels may be further distorted—or further clarified—through informal communications networks.

There is, in other words, considerable amount of complexity and "noise" in the entire process of disseminating information on hazards. This is not something that earthquake safety advocates can change. The challenge for those involved in the risk communication process is to cut through the noise with strong "signals" for message recipients. With respect to message sources, this involves first understanding what sources people typically use to obtain their information on earthquake hazards, and then using those sources and making sure that the information that is disseminated is clear, consistent, and credible. It also involves being ready to use information sources effectively when situations and events develop that stimulate information-seeking among members of the public, such as the occurrence of small earthquakes, or damaging earthquakes in other countries.

Seismic safety advocates must always be concerned with maintaining and enhancing source credibility. They face two key challenges with respect to the information sources they use in risk communication campaigns. The first is to ensure the credibility and legitimacy of the organizations that are providing seismic hazard information. The second is to identify spokespersons that audiences perceive as trustworthy. The discussions that follow provide advice on how advocates can surmount these challenges.

Factors Influencing the Credibility of Sources and Spokespersons

People are bombarded daily with information of all types from a wide range of sources. One major challenge they face in dealing with excessive amounts of information is to decide which sources are credible and trustworthy and which should be ignored. Obviously, people listen to, value, and in general are more likely to act on information they receive from sources that they trust as reliable. Conversely, these individuals tend to discount information that comes from untrustworthy sources. Even complete and accurate information will be rejected if the information source is not considered credible. Risk communication thus involves two interrelated challenges: determining which sources people consider credible, and using those sources effectively in seismic safety campaigns; and taking steps to ensure that the agencies, organizations, and individuals involved in communicating about seismic hazard maintain high levels of credibility. In a related vein, advocates should guard against doing things that are likely to damage their credibility.

What makes an information source credible? Put another way, what are the factors that damage the credibility of sources? In a publication on risk communication, the National Research Council (1989) discussed several factors that stand in the way of effective risk communication due to their impact on source credibility: (1) taking positions that appear to audiences as unjustified, in light of what people consider to be reasonable; (2) gaining a reputation for deceit, misrepresentation, or lack of full disclosure of information; (3) making statements and taking actions that contradict previous positions; (4) communicating risks in ways that appear to be self-serving; and (5) putting out messages that contradict information provided by other sources. This last point is especially problematic; in many cases risk communication efforts are accompanied by seemingly contradictory messages from various sources. Nevertheless, the challenge for seismic safety advocates is to try to see to it that the various sources that are engaged in disseminating seismic hazard information are consistent with one another.

The National Research Council report also identified other factors that affect source credibility. The perceived competence of those providing risk information is one such factor. Credible sources are those that can legitimately claim specialized knowledge concerning the topics about which they are communicating. Following this advice, information sources used by seismic safety advocates—both specific individuals and organizations and agencies—should be those that are seen by audiences as having special expertise and competence with respect to earthquake hazards. This would include earth scientists, agencies such as the US Geological Survey, and other recognized authorities. At the same time, since it cannot be automatically assumed that all recipients of risk messages understand what different scientific specialties and government agencies do, risk communicators should find ways of conferring legitimacy on the information sources they use—for example, by providing more information about sources and about the credentials of spokespersons.

Various publications have focused on factors that may may enhance source credibility and trustworthiness. According to a recent publication from the California Governor's Office of Emergency Services (2001) entitled *Risk Communication Guide for State and Local Authorities,* agencies can be expected to be seen as trustworthy if they portray a sense of competence; appear to genuinely care about the things their audiences care about; encourage meaningful public involvement in discussions on risk; appear to be honorable and honest; and are able to deal effectively with public outrage and other emotions that members of the public may express with respect to hazards. Along similar lines, Renn and Levine (1991) identified five characteristics of information sources that enhance their trustworthiness and credibility: competence; objectivity; fairness; consistency; and the ability to transmit a sense of goodwill. Others point to the importance of similar attributes, such as perceived knowledge and expertise, perceived openness and honesty, and perceived caring and concern (Peters, Covello, and McCallum, 1997). The California OES *Risk Communication Guide* (2001) offers the following advice for advocates wishing to maintain and enhance their credibility:

> Be forthcoming with information and involve the community from the outset…Focus on building trust as well as generating good technical information…Provide information that meets people's needs…Get the facts straight and avoid mixed messages…Only make promises you are sure you can keep…Follow through (p. 25).

Turning more specifically to attributes and behaviors that make individuals more credible as spokespersons, Renn and Levine (1991) argue that several factors are associated with being a good risk communications spokesperson: the ability to admit uncertainty; the public perception that the spokespersons are competent, expert, honest, altruistic, and objective; the physical attractiveness and overall appearance of the individual; and the person's ability to respond to the emotions of audience members. They also note that message recipients assign more credibility to people who are similar to them—something advocates should keep in mind in selecting spokespersons to communicate with diverse groups within the population. On the negative side, individuals are seen in a negative light if they appear arrogant and indifferent, if they are seen by target audiences as outsiders, or if they come across as too technical.

In their handbook on risk communication, Lundgren and McMakin (1998) cite a number of different factors that may affect the credibility of spokespersons. Spokespersons must be acceptable to the audience, which, in turn, affects how well they are able to respond to audience concerns. Spokespersons must also have a good track record of working with the target audience—whether that audience consists of community residents, particular groups, or decision makers—and must be able to convey information in a manner that the audience can understand. For example, in dealing with the public, spokespersons must often communicate in languages other than English and be able to clearly present scientific data and information in ways that the public can understand.

Another notable finding from research in risk communication is that it appears to be easier for a source to lose credibility than to gain it. Slovic (1993) has referred to this phenomenon as the "asymmetry principle;" essentially, people more readily perceive negative events—such as accidents and failures—than positive ones. Negative events, such as communications gaffes and messages that are seen as deceptive, also appear to have a more significant impact on attitudes than positive ones. Additionally, risk communication research has found that people tend to view sources of bad news as more credible than sources of good news. As a result, advocates should be aware that the mishandling of situations in which information about earthquake risks is communicated might result in damaging relationships of credibility and trust that may have taken years to develop. For example, care should be taken to avoid situations in which sources could be perceived as withholding vital information from audiences, or, on the other hand, releasing erroneous or contradictory information. Similarly, advocates should control any tendency they may have to release inconclusive information too rapidly, in case that information might later prove to be inaccurate. Sources should also be as honest as possible about the information they release—for example, by stating explicitly that they do not have enough information to reach definitive conclusions, or that the knowledge conveyed is the best they currently have.

Research on source credibility and trustworthiness contains a number of general lessons for seismic safety advocates. One important lesson is that, while technical expertise and knowledge clearly help a source present itself as trustworthy, factors such as perceived honesty, consistency, genuine concern for the needs of audiences, and disinterestedness also play an important role in establishing credibility. Long-term involvement with the community and an understanding of community needs also help establish the perception of credibility and trust.

Consistency is important, with respect to both information sources and spokespersons. Just as it does in interpersonal relationships, consistency plays an important role in building trust in institutions. The creation of a consistent and trustworthy image for seismic hazard information sources can be seen as parallel to the "branding" efforts of private-sector organizations. Indeed, much like corporate advertising strategies, seismic hazard information sources must be aware of their brand image, and, therefore, should seek to imbue their messages with an image of accuracy, high quality, reliability, familiarity, and concern.

There are several examples of organizations and information sources that are widely viewed as credible sources for risk communication. For example, the U.S. Geological Survey and the California Geological Survey are typically viewed as the "sources of record" for valid information on the earthquake threat. In terms of spokespersons for seismic risk, Lucy Jones and Kate Hutton are seen in Southern California as highly credible and trustworthy sources for earthquake hazard information. The decision to designate specific spokespersons to appear frequently on the media, rather than continuing to introduce new faces, was a good one, because the public likes to feel that it "knows" both organizational information providers and specific spokespersons. A longstanding and solid track record also helps institutionalize source credibility; for example, the National Hurricane Center is widely recognized as the definitive source for accurate and credible hurricane forecasts and warnings.

Intergroup Differences and Information Sources

Although there has not been much research on the extent to which various segments of the U.S. public rely on different sources for information on earthquakes and other hazards, the existing research does suggests that risk communication campaigns should take intergroup differences into account. Members of different minority groups do not necessarily turn to the same kinds of sources for information on hazards as do members of the Caucasian majority, nor do they find the same sources credible and trustworthy (Turner, Nigg, and Heller Paz, 1986; Lindell and Perry, 1992). For example, in a study on the warning responses of African-Americans, Mexican-Americans, and Caucasians, Perry and Lindell (1991) found that white respondents were more likely to identify public authorities, such as police and fire departments, as well as mass media as credible sources of hazard information. African-Americans also considered public authorities credible, but they were more likely than whites to rely on social network ties—such as family and friendship relationships—for hazards information. Mexican-Americans placed even more trust in those kinds of informal networks for information.

The important point to note here is that subgroups within the population vary with respect to the conduits they rely on for information, including information on hazards. Information sources that are used by "majority" community residents are not the same as those used by racial and cultural minorities. Moreover, as noted earlier, people assign more credibility to information sources that they see as similar to themselves. Therefore, seismic safety advocates need to closely study their own communities to identify where different groups routinely turn for hazard-related information; what institutions, organizations, leaders, and other information sources they consider most credible and trustworthy; and which leaders they trust. Rather than assuming that all members of the public will find particular institutions and spokespersons equally credible, advocates should seek out organizations and individuals that different groups within the population already consider credible and engage these groups and individuals in seismic risk communication efforts. To obtain this kind of information, it will be necessary for advocates to contact and work closely with community groups and leaders that represent various community constituencies. At the same time, they should actively work to familiarize less-well-informed groups within the population with proven sources of valid information and to make that information available in a form that is readily understandable.

Communication Channels

Communication channels consist of the various means through which hazard-related information is disseminated. Channels include both interpersonal communication networks and mass media sources. Focusing on the variety of ways information can be conveyed to the public and groups within the population, California Governor's Office of Emergency Services report on risk communication (2001) discusses a wide variety of "vehicles" that can be used in risk communication activities. These different vehicles employ both person-to-person and mass media information dissemination. Person-to-person communication channels include public hearings, conferences, workshops, courses, and door-to-door canvassing. Communication vehicles that employ the mass media include news conferences, talk shows, public service announcements, press briefings, feature articles, and newspaper advertisements. Complementing and supplementing formal risk communication efforts are the informal interpersonal channels that people routinely employ in the workplace, neighborhoods, and among family members.

As a general rule, experts on risk communication stress the importance of using multiple channels for information dissemination, rather than relying on one or two sources (Nathe, et al, 1999). A well-designed risk communication campaign is one that employs both person-to-person and mass media communication strategies. Ideally, campaigns should be designed and timed so that both types of channels are addressed simultaneously and various vehicles of communication are used within each. At the same time, as discussed in the following section on messages and message content, care needs to be taken to ensure that the messages that are conveyed through various channels are consistent and mutually reinforcing.

Socio-Economic Factors Affecting the Use of Different Information Sources

Some mass media are almost universally used in U. S. society, but there is also quite strong evidence for differential media use among different age, ethnic and racial, and income groups. Television is the most commonly used mass medium in the U.S., with 94% of the population reporting television use. Prime-time television and cable television reach slightly smaller audiences (82% and 73%, respectively). Eighty-four percent of the population reports listening to the radio, 79% read newspapers, and about 52% of the population report using the Internet. While television, prime-time television programs, and cable use do not vary much across ethnic groups in the U.S., variations are evident among these groups in radio listening, newspaper reading, and Internet use. For example, while 67% of Asian-Americans use Internet information sources, only 41% of Spanish-speaking Americans report Internet usage.

Radio use, newspaper reading, and Internet use are directly related to both education and income. That is, the higher the income and educational level, the greater the reported use of these media. These differences are particularly evident with respect to the Internet. In the case of income, for example, only18% of those with household incomes of less than $10,000 use the Internet, while 74% of those with household incomes of $50,000 or more report Internet usage. Around 16% of those who never graduated from high school use the web, while that percentage exceeds 76% for college graduates. Age is also associated with differential media use; younger populations are more likely to utilize radio and Internet information sources. While ninety percent of the 18-24-year-old age group listen to radio, 61% of those over 65 do so. There is also a strong inverse relationship between age and Internet use. While 60-64% the population between 18 and 54 reports using the Internet, those percentages drop to 49% for those 55 to 64 and 15% for those over 65.

Patterns of media penetration and differential media use are important considerations for those who are designing risk communication campaigns. As a general rule, overall coverage of the population is greatest for television and lowest for the Internet. Newspaper-based seismic educational campaigns will fail to reach one out of every five US residents (and 40% of non-high-school graduates), simply because many people don't read newspapers. Similarly, owing to the persistence of the "digital divide," campaigns based solely or primarily on Internet dissemination of information will miss large segments of the population. (Statistics taken from Congressional Information Service, Inc. 2003a; 2003b).

Strengths and Weaknesses of Different Media

Advocates must also keep in mind that not all media sources do an equally good job of communicating complex scientific information. Among mass media sources, television can provide dramatic images that attract viewers' attention, and it offers the potential for providing informative visual material, such as hazard maps, in an easily understandable manner. However, television is also an ephemeral information source; people watch, and under ideal circumstances they assimilate and retain all or some of the information provided. However, unless they tape the program or segment, they generally have no way of saving or referring back to the information later. Additionally, with the exception of documentaries, television coverage tends to be brief and lacking in detail. Radio lacks the visual drama of television. In addition, much like television news reports, most radio news consists of very brief segments, rather than in-depth feature coverage. Like television, radio is also ephemeral. The kinds of radio stories that provide in-depth, useful information on hazards are likely to be aired on public radio, a "prestige" medium whose use varies with education, income, and ethnicity. Regarding the strengths and weaknesses of different mass media, Gutteling and Wiegman (1996: 177) note that:

> [A]udiovisual media will probably be most effective with simple messages. Written materials should be preferred for complex issues. The reasoning behind this notion is relatively straightforward. A written message can be processed more easily, repeatedly, and at the receiver's own pace, which may be necessary to understand complex information. Television provides the receiver with only one opportunity to process the information. With complex information, this is most likely not enough for adequate processing.

What this means is that because of the ephemeral nature of TV and radio, information—including information on hazards—needs to be disseminated repeatedly and consistently over time in order to have an impact. It also means that, given the complex nature of earthquake hazards and earthquake safety-related issues, print media are more likely than electronic media to influence audience perceptions and behaviors.

As the above passage suggests, newspapers are generally capable of providing more detailed content than either television or radio. Newspaper stories on risk can also be accompanied by eye-catching graphics that convey needed information. As a medium, the newspaper also has the advantage of being storable—provided readers can be encouraged to save relevant newspaper stories.

In virtually the only systematic study that has attempted to assess the impact of a specific seismic risk communication strategy, Mileti, et al. (1993) observed many potential benefits to distributing risk information through newspapers. In this study, for example, Mileti and his colleagues evaluated a 23 page brochure inserted in San Francisco area newspapers on September 9, 1990. The insert contained detailed information on the likelihood of future earthquakes, potential ground shaking intensity maps, advice for residents on how to mitigate hazards and prepare for earthquakes, and suggestions on how residents can learn more about seismic risk and earthquake preparedness. In subsequent surveys and interviews with business representatives, Mileti and his colleagues found that about half of the residents surveyed had seen the insert, and that almost everyone who had seen it recalled reading it. Many found that the insert had provided new information, most found the information useful, and they were able to recall specific information that had been contained in the brochure.

The newspaper insert was also found to have had a measurable impact on willingness to prepare for future earthquakes. The researchers concluded that this positive effect had to do not only with the information that was provided, but also with the fact that the brochure stimulated additional information seeking and interaction among members of the target audience. When people received consistent information from a range of sources, they were more likely to act.

At the same time, as noted earlier, newspapers tend to be read by better-educated, higher-income members of the population. Since so many members of the public either do not read newspapers or are poor readers, it is not clear whether printed materials will reach less-well-off and less-well-educated segments of the population. To make sure that messages reach those audiences, materials should be distributed through print media that are routinely used by different groups, and in languages spoken and read by those audiences. The Bay Area newspaper insert, for example, was distributed in English, Spanish, Chinese, Braille, and recordings for the blind.

Much faith is being placed in the Internet as a source of information on hazards, both during non-disaster times and in the context of disaster events. For example, the U.S. Geological Survey has recently developed an Internet-based product called *ShakeMap* that is capable of providing information on earthquake epicenters and shaking intensities in near-real time. Many in the general public have responded to Internet-based questionnaires that request information on their own experiences during earthquakes. The Internet would seem to make an ideal risk communication tool owing to its ability to provide large amounts of information, including maps, graphics, and real time information, as well as its ability to store information that can be retrieved as needed..

However, while the Internet clearly has enormous potential as a medium, its drawbacks must also be recognized. One such drawback is the "digital divide" revealed in the media usage statistics cited above. Although the situation is changing rapidly, as noted earlier, Internet use is currently highly structured by age, income, educational level, and ethnicity. Another drawback is the problem of sheer information overload, coupled with potential problems of source credibility and inconsistency. Indeed, with its immense complexity and staggering amount of content, the Internet is a repository for truth and myth, science, pseudo-science, and superstition, current and accurate as well as out-of-date information.

Avoiding Overreliance on Mass Media

One of the most durable findings in mass communications research, first articulated by Paul Lazarsfeld and his colleagues (1948), centers on the importance of the "two-step flow" of communications—that is, the relationship between information obtained through formal channels, such as the media, official sources, and opinion leaders, and informal channels, such as family, friendship, and other social networks. As indicated earlier, people receive information from formal sources and opinion leaders and process that information through their own interpersonal communications networks. Conversely, communications within social networks may give rise to information-seeking from official sources. Opinion-formation and decision-making take place as people receive information from a variety of sources, interpret and compare that information, and seek additional information to address doubts and inconsistencies.

Research also suggests that media campaigns alone are insufficient to motivate behavior change, including the adoption of self-protective behaviors. In a review of research on the role of media in promoting positive health-related behaviors, Redman, Spencer, and Sanson-Fisher (1990) concluded that, when used alone, the media do a very poor job of influencing behavior change. More success is achieved when mass media campaigns are used in conjunction with community-oriented programs promoting the same behaviors—for example, presenting media messages encouraging people not to smoke, and at the same time providing a hotline through which people can access information on local programs devoted to smoking cessation. These authors concluded that, at least in the case of the studies they reviewed, "[w]hile the mass media may not be effective in directly altering behavior, an alternative view of their role is that they can supply motivation or awareness of a health problem which can later be built on by other intervention strategies" (1990: 95).

These findings suggest that the most effective communications strategies are those that use mass media to disseminate information but that also recognize that message recipients will turn to other informal information sources for confirmation of what they hear from the media. To be effective, media campaigns must be supplemented with community programs that provide additional information, such as school- or neighborhood-based programs. One important lesson from research is that media dissemination constitutes only one phase of a process that also seeks to employ the organizations and social networks with which community residents are involved as risk communication channels. This is especially important for campaigns that actively seek behavior change among information recipients. The general rule is that while media-focused risk communication strategies are a necessary component in any seismic safety campaign, in and of themselves they will never be sufficient to influence target audiences.

It should also be kept in mind that in addition to serving as channels for communicating information to various audiences, the mass media also perform an important agenda-setting function with respect to public policy issues—including issues related to seismic safety. That is, through their reporting, the mass media have a tremendous ability to increase or decrease the salience of policy issues both within the public and among influential groups (Shaw and McCombs, 1977).

Messages: The Importance of Content and Consistency

Risk communication activities have different objectives. In some cases, risk communication efforts seek to inform audiences about a particular risk in order to influence risk decisions. In others, the goal is to influence message recipients to undertake some specific action with respect to the risk—for example, to evacuate in the face of an immediate threat, purchase insurance, or retrofit a home (Covello, et al., 1987; Morgan and Lave, 1990). Some risk communication efforts center on trying to make a particular risk more salient to audiences and to make them more concerned. Other risk communication efforts may try to calm audiences down and address their concerns in order to limit unnecessary or unrealistic fears about a particular threat. The last-mentioned type of risk communication challenge is probably best illustrated by the case of the 1990 Iben Browning earthquake "prediction." The Browning prediction, which forecasted a large-scale seismic event in the Central U.S. in December 1990, gained salience with many audiences, including mass media outlets. Most likely, the public response to this prediction would have been more measured and skeptical had the scientific community been quicker to inform the public of its lack of scientific validity.

This discussion will center on seismic hazard risk communication strategies and messages that seek to both inform the public about earthquake hazards and encourage self-protective behavior. A key challenge here is to combine accurate and understandable information about the earthquake threat with concrete guidance on what people can do to protect themselves against the hazard. This is no small undertaking, since it involves both being able to effectively communicate about the hazard itself and being able to provide information on a range of adjustments message that recipients might adopt.

As indicated earlier, the difficulties associated with communicating earthquake risk are further complicated by the fact that virtually everything related to the hazard—including the effectiveness of various protective measures—is accompanied by uncertainty. Thus, in addition to providing information that is reliable, valid, and current, messages must be formulated in ways that help audiences appreciate the uncertainties involved in communications regarding the earthquake hazard, yet at the same time not be so confused by them that they decide against taking any action.

Characteristics of Effective Risk Communication Messages

Many people assume that failure to prepare for earthquakes and other disasters is a consequence of conscious individual decision-making. People are seen as not sufficiently interested in engaging in self-protective measures or as preferring to take risks and then wait for government assistance in the event a disaster should occur. It is clear that many risky behaviors are the consequence of intentional individual and group choices. Yet at the same time, in the case of natural hazards it is equally probable, if not more likely, that inaction is the result of failure to understand hazards and personalize risks, coupled with a lack of knowledge about what to do to reduce risks or an inability to carry out those measures. For example, Lave and Lave (1991), who studied why people do so little to protect themselves from floods and why so few insure their properties against floods, found that only a relatively small percentage of people actually understand flood hazards. The researchers also found that many people find flood maps and other governmental publications on flood hazards difficult to understand. The study concluded in part that FEMA and other responsible authorities should strive to improve their flood-related risk communication activities by addressing the questions and concerns of at-risk populations in a way that they can understand.

As with flood hazards, the challenge associated with communicating about earthquake hazards is to develop messages that help audiences understand the hazard, understand the extent to which they are personally at risk, know what that information means in terms of potential losses, know what they can do to reduce their risks, and also have adequate information about where they can go for more information on both the hazard and appropriate loss-reduction measures. It is the responsibility of seismic safety advocates to ensure that the information they provide addresses these needs.

The research literature contains a great deal of advice on how to craft effective risk communication messages, including both messages used during "normal," non-disaster times and those used to issue warnings in the context of specific threats. Based on a systematic review of numerous studies, Mileti and Fitzpatrick (1994) offer the following guidance with respect to the content of risk communication messages:

- Consistency in message content is extremely important. Inconsistencies lead to misunderstanding and inaction. The information provided should be consistent across time, as well as across different message sources and channels.

- The information that is provided should be accurate, timely, and complete. In situations in which incomplete or contradictory information may have been provided, those discrepancies should be explained. Complete accuracy throughout documents and messages is key. Indeed, even small or seemingly unimportant inaccuracies may call into doubt the reliability of the entire message.

- The language used in risk communication messages should be clear, simple, and easy to understand. In other words, technical jargon and unfamiliar terminology should be avoided to the greatest extent possible.

- Messages should convey a sense of confidence in the information that is being provided. Confidence and a sense of certainty should be maintained even in situations involving probabilities and ambiguous information. Message recipients should not be left with doubts about whether to take the information seriously. The importance of certainty and confidence extends both to the information conveyed and to the way in which it is conveyed—including the behavior of official spokespersons.

- Messages should be released as frequently as possible. Frequency influences both attentiveness to and belief in the information that is being communicated.

- Messages should contain information about the anticipated event, its likelihood, and its probable effects in as much detail as possible. It is not sufficient to merely provide general information on when and where earthquakes may occur. Detailed information should be provided on the earthquake and on various types of seismic effects, such as fault rupture, ground shaking, liquefaction, and damage to the built environment.

- Message content should include information on the location of relevant risks and hazards. Risk information that is geographically specific encourages message recipients to personalize these risks.

- Messages should also contain specific guidance on what people should do with respect to the hazard and when they should take those actions. Along those same lines, the message should inform audiences about where they can go for additional information and assistance with carrying out recommended measures.

Looking further into the implications of this advice, it is clear that maps, charts, photographs, film images, and other visual materials are important to the communication of seismic risk information. Visuals can provide needed information on the effects of earthquakes, including information on the location of specific impacts that can help people better understand and personalize risk. At the same time, visual materials must be clear and easy to understand, and there must be consistency between risk communication texts and the visual information that accompanies them. The previously discussed earthquake hazard insert in Bay Area newspapers , described by Nathe et al. (1999) as the "gold standard" for risk communication, contained all the requisite elements for effective risk communication, including clear and concise text, easy-to-understand maps and information on earthquake probabilities, advice on what readers could do to protect themselves, and guidance on where to go for additional information.

Message Recipients

Effective risk communication and public education campaigns are those that can reach, can be easily understood, and can be acted on by their target audiences. Again, accomplishing these goals presents a significant challenge, particularly in a diverse society. This section contains a series of brief discussions on things that advocates should take into account in developing their risk communications strategies. Those points include understanding how message recipients deal with risk-related information, particularly probabilistic information; developing strategies for communicating both with key actors and opinion leaders and with the public; and understanding audience diversity.

Recognizing Audience Diversity

In his paper "Thinking About Audiences," Peter May established a typology for classifying advocacy groups. These groups include governmental decision makers at the authoritative policy, managerial, and policy influence levels; private-sector decision makers at both authoritative and policy-influencing levels; professional influence sources, including consulting engineers, planners, insurers, and other types of advisors who can play an advocacy role in seismic safety; and external sources of influence, consisting of those groups that have a stake or interest in seismic safety issues. This list is already quite broad, but it could be broadened further to include nonprofit organizations with significant hazard-related advocacy responsibilities, such as the Red Cross. Professional influence sources also include university-based researchers with relevant expertise.

Using this framework, May identified approximately forty different audiences or potential advocacy groups, along with their information needs, functions, and the roles they play in the policy adoption and implementation process. It is neither feasible nor necessary to develop specialized risk communication messages for each of these groups. Rather, the goal should be to design risk communication strategies that are consistent with their main functional roles–for example, guidelines that would enable those whose role it is to influence policy to be more influential and persuasive with target audiences, or that would enable decision makers to make appropriate decisions more easily. In other words, risk communication strategies should take into account both the needs and normal activities of different groups. Additionally, informational materials should be designed to be consistent with the kinds of data and information those groups commonly use and prefer in their professional roles. For example, organizational and community decision makers and technical experts differ in terms of the kinds of written materials they generally use and find informative. Experts may find complex discussions of probabilities extremely interesting and useful, while the same information will likely be seen as too complicated and overly vague by decision makers. Information on risk should be packaged in ways that make that information accessible and immediately usable by different audiences.

Individual and Group Differences in Risk Perception

It would seem reasonable to assume that when members of the public receive clear, concise, and accurate scientific information on some hazard, they will perceive and process that information in much the same way and reach similar conclusions concerning the threat. However, decades of research indicate that is not the case. Instead, presented with the same information, people typically respond in very different ways.

Receptivity to and processing of risk information are related to a wide range of factors, including: sociodemographic factors, such as race, social class, gender, and education; personality characteristics, such as the tendency to feel fatalistic or, on the other hand, to have a greater sense of personal control; experience with the hazard in question; attitudes concerning information sources, including views on the credibility and trustworthiness of scientific experts; attitudes towards recommended loss-reduction activities—for example, how easy or difficult those actions may be; the ways in which risk information is contextualized or "framed" by those providing risk information; perceptions of what others are doing with respect to the hazard; and general worldviews held by audience members. The brief discussions that follow are not comprehensive, but rather are meant to illustrate a few ways in which different segments of the public differ in their views with respect to hazards.

Regarding racial factors in risk perception, in her study of racial groups and environmental hazards, Vaughan (1995) found that African-Americans tend to be more distrustful of official information sources than the Caucasian population. African-Americans were also found to perceive and "frame" toxic hazards differently than the white majority. While official sources may communicate information about toxic threats in ways that emphasize scientific probabilities or use the language of cost-benefit analysis in discussions on toxic remediation, African-Americans may frame those same hazards in terms of justice and fairness—viewing themselves as disproportionately exposed to toxic hazards.

Many other studies have pointed to racial/ethnic, gender, and household-related differences in risk perception and behavior. Women generally perceive risks differently from men and are generally more risk-averse (Cutter, et al., 1992). According to a body of literature cited by Fothergill (1998), gender influences a range of hazard-related perceptions and behavior, including exposure to hazards, risk perception, preparedness and response behaviors, vulnerability to the physical and psychosocial impacts of disasters, and participation in response and recovery activities. In a study on technological and health risks, for example, researchers found that risk perceptions differed between Caucasian males and females, as well as from those of non-white males and females. Caucasian males were significantly less likely than members of other groups to perceive a range of different hazards as risky. This pattern, known as the "white male effect," appears to be related to their higher trust in societal institutions and their greater tendency to see individuals as responsible for making their own choices about the risks they face (Flynn, Slovic, and Mertz, 1994. For further information on ethnic diversity and risk perception, see Vaughan and Nordenstam (1991)). The presence of school-age children in the home is another factor that influences both knowledge concerning hazards and the adoption of hazard adjustments.

Given the literature on differing perceptions of risk among social groups, how should seismic safety advocates proceed? On the one hand, since risk perceptions and actions with respect to hazards are related to factors beyond their control, such as gender, ethnicity, socioeconomic status, and individual beliefs, advocates could conclude that there is little they can do to affect attitudes and behavior among some segments of the population. On the other hand, however, a better strategy would be to acknowledge individual and group differences and address them to the greatest extent possible. For example, anti-smoking campaigns have successfully utilized school-based risk communication outreach to influence the attitudes and behavior of students as well as their parents. Similarly, children-centered earthquake education campaigns appear to be having some success. Some research suggests that providing information that makes people feel more confident that they have the resources necessary to manage the earthquake threat encourages the adoption of self-protective behavior (Mulilis and Duval, 1995). Risk communication messages can be developed that convey that type of information. Along those same lines, Vaughan (1995) noted that one major strategy for communicating risks and bringing about behavioral changes among low-income and minority populations—groups that typically feel little sense of control over their own lives—is to engage their participation in risk-reduction activities and increase their sense of empowerment. Similarly, once barriers associated with education and scientific knowledge are recognized, they can be addressed through the development of simple and clear message content and graphics that communicate hazard information in ways that are easy for those with limited language skills to understand.

Concluding Comments: Putting the Pieces Together

Advice abounds on how to communicate with the public and stakeholders about seismic hazards. Based on a review of seismic hazard risk communication studies, Nathe (2000), for example, highlights the following six "immutable laws of public education programs": (1) programs must explain complicated phenomena in non-technical terms; (2) messages must come from a variety of credible sources: (3) disseminated messages must be consistent, regardless of which media are used; (4) while television and radio messages are effective, printed messages are the most effective manner to disseminate risk-related information; (5) the information provided must enable people to understand what they can do before, during, and after earthquakes; and (6) information is most likely to be believed and accepted if individuals have the opportunity to discuss these messages with their peers.

In another recent document on public hazards education, Mileti (2003) also provides guidance on how to craft successful educational campaigns. Among the points he makes are that: people factors always must be taken into account in any communications strategy; effective hazard education must be seen as ongoing, rather than as a one-time effort; and campaigns work best when people come to believe that taking action was their own idea. Like Nathe, Mileti has developed his own list of what he terms "laws" of effective public hazard education, many of which have already been touched upon earlier. In addition to discussing concrete steps advocates should take, however, Mileti also makes a more general point that advocates need to keep in mind, which is that the goal of hazards communication campaigns should be to create in the minds of audiences a sense of uncertainty, a willingness to question, and an interest in learning more about their environment and their own levels of safety. In other words, educational advocacy efforts must seek to overcome people's tendency to take their own safety for granted, and to encourage them to talk with others about the earthquake threat and seek out additional information. To the extent advocates can succeed in breaking through that reluctance to face potentially unsettling information, they will have taken the first step toward motivating change.

Timing is clearly a factor in bringing about behavior change. When are people most likely to be receptive to seismic risk communication campaigns? Clearly earthquakes are "windows of opportunity" that can stimulate behavioral change. This includes both earthquakes taking place in a community and distant events that can be made relevant to local audiences. For example, the 1985 Mexico City earthquake proved to be a "teachable moment" for some communities in Southern California. Shaken from their tendency to feel hazards won't affect them, people are more receptive to information and more willing to act when they see the death and destruction earthquakes can produce. However, the time when an earthquake strikes is no time to begin designing educational campaigns. As Mileti (2003: 6) cautions:

> …while people are more apt to alter behaviors after a disaster strikes, *change after a disaster is most likely when public educators have already worked to make sure the problem is recognized, the solution is known, and some advocates are already in place.* Do not wait for the window to open; build a sustained advocacy program beforehand. Not working constantly may result in waiting forever. (Emphasis added.)

As this quote suggests, communicating about earthquake risks, and seismic safety advocacy more generally, are activities that must be sustained over time if they are to be effective. The advocacy success stories outlined in this volume point clearly to the role of persistence in making change happen. In educating the public, stakeholder groups, and decision makers, advocates must think in terms of long-term strategic planning involving informational products and educational activities that reinforce and build upon one another. This requires in-depth knowledge of the earthquake hazard, media savvy, an understanding of the needs of audiences, resources that are adequate to the task, and above all an ongoing commitment to raising awareness and stimulating public action. More strategies for building public support for earthquake safety initiatives are discussed in other chapters in this volume, such as "Mobilizing Support for Seismic Loss Reduction."

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Guidance for Seismic Safety Advocates: Mobilizing Support for Seismic Loss Reduction

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Introduction

This guidance for seismic safety advocates on mobilizing public support for enhanced earthquake loss reduction activities starts with the assumption that such advocacy efforts have a lot in common with other attempts at bringing about social change through organized action. Since this is the case, it is possible to draw on several literatures and on empirical examples of other social change-oriented activities in order to develop successful strategies. Those literatures include studies on social movements, political agenda-setting, coalition-building and interest-group politics, and the program planning and implementation process. Studies on mobilizing strategies used in community-based loss-reduction initiatives such as Project Impact also provide insights for earthquake safety advocates.[10]

This paper is directed toward groups and individuals seeking to act as earthquake loss reduction change agents. These advocates include people in local, state, and regional governmental agencies whose job-related responsibilities include promoting seismic safety; design professionals who want to help bring about change through influencing the policy process; risk managers, code officials, and others who have a stake in increasing seismic safety based on their own professional interests; citizen groups seeking to promote loss-reduction measures for earthquakes and other disasters; elected and appointed officials who are interested in issues related to earthquake loss-reduction; and others who have the potential for taking action to promote the adoption and implementation of seismic safety measures. The advice presented here targets audiences for whom seismic safety is already salient and who are seeking a better understanding of how to gain support for their advocacy efforts. It is not intended to persuade those who are not already interested in earthquake safety issues. The objective of the paper, in other words, is to provide people who are already self-identified advocates with concepts and strategies they need in order to persuade others to support their change-related activities.

Background: Why Advocacy For Earthquake Safety Is So Challenging

While advocacy and the mobilization of public support for seismic safety resemble other types of advocacy in many ways, strategies employed by advocates must also take into account the distinctive characteristics of the earthquake threat. From the point of view of most members of the general public and most politicians, earthquakes constitute "low probability/high

[10] The Disaster Research Center has been studying the Project Impact implementation process since 1998. Findings from that research are reported in several DRC reports. See, for example, Nigg, Riad, Wachtendorf, and Tierney (2000); Wachtendorf and Tierney (2001); Wachtendorf, Connel, Monahan, and Tierney (2002).

consequence" events. Research indicates that mobilizing support to respond to those kinds of hazards can be especially problematic, owing to the tendency of many to think of low probabilities as zero probabilities. Additionally, the reality of political life in this society is that politicians have limited time horizons and often find it very difficult to develop and support policies whose payoffs may come only in the distant future. At any given time, political agendas only have "room" for a limited number of items; low-probability/high consequence risks have a difficult time competing for agenda space with other issues that are more pressing and that have well-organized, active, and powerful constituencies.

The low salience of the earthquake problem in most communities and among many constituencies creates challenges for advocates. Both members of the general public and political figures tend to be relatively indifferent to the earthquake threat, except in the immediate aftermath of earthquake events. Daily concerns are simply more compelling for both community residents and political leaders. Research on the media and agenda-setting indicates that public opinion on political and social issues follows and is influenced by information provided by the media (McCombs and Shaw, 1972; McCombs, 1993). This is particularly true for issues with which the public is not directly familiar. In most parts of the U. S, media stories on the earthquake threat are quite infrequent, except when a dramatic and newsworthy event occurs.

In many respects, earthquake-safe communities can be thought of as a public good—that is, as a benefit that can be enjoyed by all members of the public, regardless of the size of their individual contributions to the realization of that good (Olson, 1965). As is the case with other types of public goods, individuals may see little reason to invest their time in helping to increase levels of earthquake safety. Like others who advocate for public goods, seismic safety advocates must find ways of overcoming this tendency, known as the "free rider problem."

Further complicating advocacy efforts is the fact that members of the general public and important constituencies may not actually understand how much (or how little) protection against earthquake hazards they currently enjoy. For example, people may know that building codes offer protection against earthquake damage and may therefore believe that current codes are sufficient to provide earthquake safety—without realizing that codes reflect a life safety standard or that the vast bulk of the structures in their communities were not built to current codes and thus do not even provide that level of protection. For example, focus group interviews conducted in 2001 by the Disaster Research Center with representative groups of residents, business owners, politicians, and practicing engineers in California's East Bay region revealed considerable variation in understandings of earthquake safety and vulnerability in that region. While group participants were quite aware of the existence of earthquake-resistant codes and building practices in the Bay Area, non-engineers were much less clear about what kinds of protection those measures actually afforded. Activities aimed at mobilizing support must thus have a strong educational component and must emphasize how safe—and how vulnerable—communities actually are.

Another related barrier that must be overcome is that members of the public and key interest groups may lack a clear understanding of the true costs and benefits associated with earthquake programs that are being advocated. This barrier is difficult to surmount where hard data are lacking, but it is critical that advocates find ways of giving the public at least some general idea both of what will be gained through loss-reduction activities and of the consequences of inaction. For example, data on the likely costs of retrofitting unreinforced masonry buildings had to be available before political figures would move to adopt the Division 88 seismic code in the City of Los Angeles. When people have doubts about how much measures will cost, how likely they are to be effective, and what benefits will result from adoption, mobilizing support for seismic safety will be much more difficult. Ideally, then, advocates should be able to speak authoritatively about specific measures that are most likely to be cost-effective in dealing with specific problems related to earthquake hazards—and thus able to promote those measures with a high degree of credibility. Where such information is lacking, advocates should seek out existing research and, if necessary, fund new research that provides a more solid basis for making claims concerning costs and benefits of various loss-reduction measures.

Efforts to mobilize public support for earthquake safety must also take into account the fact that politically powerful private-sector groups, as well as public-sector organizations, may oppose seismic safety programs. These powerful groups include development and real estate interests and owners of buildings that would be affected by new codes and regulations. Private sector firms generally resist any new programs that would increase their construction and operating costs. For their part, cash-strapped local governments can be expected to be less than enthusiastic about any programs that they as unfunded mandates. With respect to earthquakes and other hazards, local governments face what Burby and May (1998) refer to as a "commitment conundrum." Because there is a lack of basic political will to address hazards and other environmental problems, mandates generate opposition and political backlash, while voluntary programs are carried out slowly and halfheartedly. Addressing this lack of commitment is a major challenge for advocates.

Thus, as is the case with many change-oriented efforts, advocates must work against both indifference and active opposition. Such advocacy is made all the more difficult by the fact that the groups that routinely oppose seismic safety measures, such as developers and real estate interests generally (see, for example, Logan and Molotch, 1987) are in fact the same groups that studies have shown wield very significant power in local political arenas. At the same time, local advocates have some basis from which to launch their efforts, in that organized constituencies devoted to the promotion of seismic safety do exist to at least a minimal degree. Described by Stallings (1995) as the "earthquake establishment," this interest group consists of earth scientists and engineers in both academic and government settings, representatives of occupational and professional associations concerned with the earthquake threat and disasters more generally, including those associated with the insurance industry; and some legislators. The fact that there are groups that are actively concerned with improving seismic safety is one of the reasons why there has been some degree of progress on seismic policy over the years. It should be noted, however, that the "earthquake establishment" is an interest group composed of experts, not members of the general public. Lack of active public involvement in seismic safety is another barrier that advocates must seek to overcome.

Advocates must recognize that, except for generating interest among small groups of experts, earthquake safety is in many ways a "policy without a public" (May, 1991). Policies that lack publics present special challenges, in part because advocacy requires major investments in terms of time, money, and effort, the chances of success seem remote, and few incentives exist to encourage mobilization. In the absence of publics, policy arenas can be "captured" by interests that push for their own specific policy definitions and solutions, narrowing debates on policy options. While the absence of publics may in some ways permit more latitude for advocates, it also means that there will likely be little interest in and support for whatever measures are ultimately adopted. Under such circumstances, "[m]andates will be ignored, rather than challenged or redefined; inducements will be of limited interest, rather than widely accepted but abused; changes in authority of institutional relationships will be more readily accomplished, but with more limited impact" (May, 1991: 199). Seismic safety advocates must thus compensate for the relative absence of active publics in the earthquake policy arena through a combination of education, the mobilization of supportive constituencies, and the neutralization of opponents. They must also be prepared to keep the pressure on throughout the entire policy formulation, adoption, and implementation process. A key insight here is that groups that are opposed to seismic safety will ultimately realize their objectives unless strategies are employed to keep supporters mobilized.

How to Mobilize Public and Interest Group Support: General Guidance for Advocates

The sections that follow provide research-based guidance that advocates should take into account as they formulate strategies aimed at mobilizing support for earthquake safety measures. As indicated earlier, the guidance provided here is based not only on research centering on earthquakes and other disasters, but also on research outlining ways of developing support for social-change-oriented efforts more generally.

Follow Advice Provided Elsewhere in This Set of Reports and in Other Existing Guidance Documents

The various materials that are being produced as part of this project are not stand-alone documents. Rather, they are meant to serve as a suite of resources for advocates who are involved in various ways with seeking solutions to the earthquake threat. Other guidance documents focus on risk communication, policy formulation, adoption, and implementation, and examples of successful advocacy strategies. No one report contains all the guidance advocates need, but taken together, they provide suggestions on solving many different types of problems advocates in the earthquake safety area face.

Advocates should also review and take advantage of the many other guidance and "how to" documents that have been developed for earthquakes and other hazards. Existing materials provide step-by-step advice on how to carry out various kinds of advocacy activities and also include information that can help bolster arguments in favor of loss-reduction. Examples of such materials include:

- California Seismic Safety Commission: "Earthquake Risk Management: A Toolkit for Decision-Makers"
- California Seismic Safety Commission: "Earthquake Risk Management: Mitigation Success Stories"
- California Seismic Safety Commission: "Guidebook to Identify and Mitigate Seismic Hazards in Buildings"

- California Seismic Safety Commission: "Creating a Seismic Safety Advisory Board"
- California Seismic Safety Commission: "California at Risk: Steps to Earthquake Safety for Local Governments"
- Earthquake Engineering Research Institute: "Financial Management of Earthquake Risks"
- Earthquake Engineering Research Institute: "Incentives and Impediments to Improving the Seismic Performance of Buildings"
- Earthquake Engineering Research Institute: "Public Policy and Building Safety"
- Earthquake Engineering Research Institute: "Construction Quality, Education, and Seismic Safety"
- Institute for Building and Home Safety: "Natural Hazard Mitigation Insights"
- Federal Emergency Management Agency: FEMA 313, "Promoting the Adoption and Enforcement of Seismic Building Codes"
- Federal Emergency Management Agency: FEMA 364, "Planning for a Sustainable Future: The Link Between Hazard Mitigation and Livability"
- Federal Emergency Management Agency/American Planning Association: "Natural Hazards Element of a Local Comprehensive or General Plan"
- Federal Emergency Management Agency: FEMA 372, "Mitigation Resources for Success" (CD-ROM)
- Federal Emergency Management Agency: FEMA 386-2, "Understanding Your Risks: Identifying Hazards and Estimating Losses"
- Federal Emergency Management Agency: "Report on Costs and Benefits of Natural Hazard Mitigation"

Understand the Policy Process and the Contexts in Which Seismic Safety Decisions Are Made

As with policies of all types, earthquake safety policies proceed along a series of semi-independent tracks, all of which have an impact on the ultimate outcomes of the policy process. Those tracks consist of problem identification—in this case, the identification of risks and vulnerabilities; policy initiation, i.e., efforts to place the problem on policymakers' agendas; the formulation of loss-reduction measures, followed by their adoption; and the implementation of those measures (Berke and Beateley, 1992). Thinking about seismic safety policy as a process calls attention to the fact that, like any process, advocacy is only complete when its final stage of policy implementation has been successfully completed. No program or measure, regardless of how enthusiastically it is adopted, can be effective unless it is properly implemented on a large enough scale to actually have an impact. From the earliest point of policy initiation, advocates must be thinking ahead and developing strategies for subsequent phases of the process.

Rather than viewing the policy process as occurring in stages, as many analytic frameworks do, it is more appropriate to think of the process holistically—that is, to take into account all phases of the process simultaneously. In weighing different policy options, advocates should begin thinking about what actions will need to be taken with respect to "downstream" activities, such as policy adoption and implementation. Put another way, any decisions that are made concerning the formulation and initiation of seismic safety measures must also include consideration of the feasibility of adoption and implementation and of what will be required in order to successfully implement those measures. If advocates begin to think of the process in this way, they will become more aware of potential barriers that could develop later in the policy process—for example, difficulties that may arise in getting those solutions adopted or effectively implemented at a later point.

Policies invariably have consequences that differ from advocates' original intentions.. As they formulate potential solutions to earthquake-related problems, advocates should be mindful not only of intended and desired outcomes of the measures for which they advocate, but also of potential perverse and undesirable effects—and they should take steps to minimize those effects. In an illustrative example involving one policy initiative, the seismic rehabilitation of multi-family residential structures, prior to adoption and implementation, efforts needed to be made to determine the potential impact of seismic retrofit programs on the supply of affordable housing. It was thus necessary to focus on the extent to which landlords might demolish apartment buildings rather than comply with seismic ordinances, whether and how much they would raise rents to cover their costs, and whether they would force tenants to move during seismic rehabilitation or use seismic upgrading to "gentrify" their properties. Regarding hospital seismic safety programs in California, as indicated in other materials prepared for this project, there is currently considerable discussion on whether SB 1953, which requires extensive seismic upgrading of hospitals, might cause hospital operators to close facilities rather than bringing them into compliance, affecting in particular access to health care for inner city residents.

Along with thinking of the policy process in holistic ways, advocates must also avoid assuming that the process is rational and linear (Berke and Beatley, 1992). Like all efforts to bring about social change through the policy process, seismic safety is inherently political and non-linear. As noted earlier, the formulation, adoption, and implementation of seismic safety measures are influenced by the interests of powerful political constituencies, including strong and committed opponents whose opposition must be neutralized. Their likely responses to suggested policies must be taken into account throughout the policy process. Additionally, as described in the Alesch and Petak report prepared for this project, which is entitled "Gaining Attention," in policymaking, problem definition and the development of solutions to problems are at best loosely-coupled, and problem definitions and solutions can occur in any order (Kingdon, 1984; Alesch and Petak, 1986). As Berke and Beatley (1992: 28-29) observe with respect to hazard policy: "…people do not first clearly recognize hazards and then seek solutions to them. The process of problem definition and solution development do not occur in sequence. Problems and solutions exist independently. Some problems have no apparent solutions, and some solutions are suggested in the absence of a matching problem." One implication of this observation is that advocates should familiarize themselves with a range of available "solutions" to the earthquake problem, so as to be well-prepared when "problems" ultimately present themselves, either as a consequence of the occurrence of an earthquake or through efforts that succeed in putting earthquakes on the public agenda. (See discussion below on political opportunity structures and windows of opportunity.)

Along these same lines, as they attempt to mobilize support for loss-reduction, advocates must adopt a multi-stakeholder perspective on the solutions they advocate. That is, they must be able to see the earthquake problem and proposed solutions from the perspectives of supporters, opponents, those who will have responsibility for implementation, and those who will ultimately be affected by program implementation. Advocates must be able to understand and take into account how the solutions that are being promoted appear from these different perspectives, and, equally important, what types of considerations are most likely to influence various stakeholders. Focusing on building owners, for example, as seen in Figure 1 on the following page, building owners' decision processes regarding seismic safety are influenced by a host of factors, including the type of ownership (public, private, non-profit); the characteristics of the structures in question; the level of risk; what the owner intends to do with the building (e.g., keep the building for decades, sell it immediately); potential legal liability; what will happen to occupants while seismic work is being carried out; economic conditions; existing rules with respect to hazard disclosure; perceived costs and benefits of undertaking seismic safety measures; and the availability of financial assistance for undertaking those measures, among other things (adapted from California Office of Emergency Services and Earthquake Engineering Research Institute, 1998). If advocates wish to see structural seismic safety policies implemented, they must be keenly aware of the context in which owners make decisions. The same is the case for other hazard adjustments, such as land-use regulations and preparedness measures, and for other stakeholders.

While striving for the best possible policy solutions to earthquake safety issues, advocates must be willing to compromise and engage in political trade-offs. They must be able to gauge what policy options have the best chance of being adopted and implemented under different circumstances. This involves not only understanding the sources and strength of opposition to the adoption of various approaches, but also understanding what roadblocks are likely to develop during the implementation process. For example, after looking in a holistic way at the entire policy process, advocates might find themselves forced to choose between less-than-optimal outcomes, e.g., an aggressive seismic safety program that will be vigorously opposed and perhaps only partly implemented over a long period of time, versus a less strict measure that has a greater likelihood of full implementation.

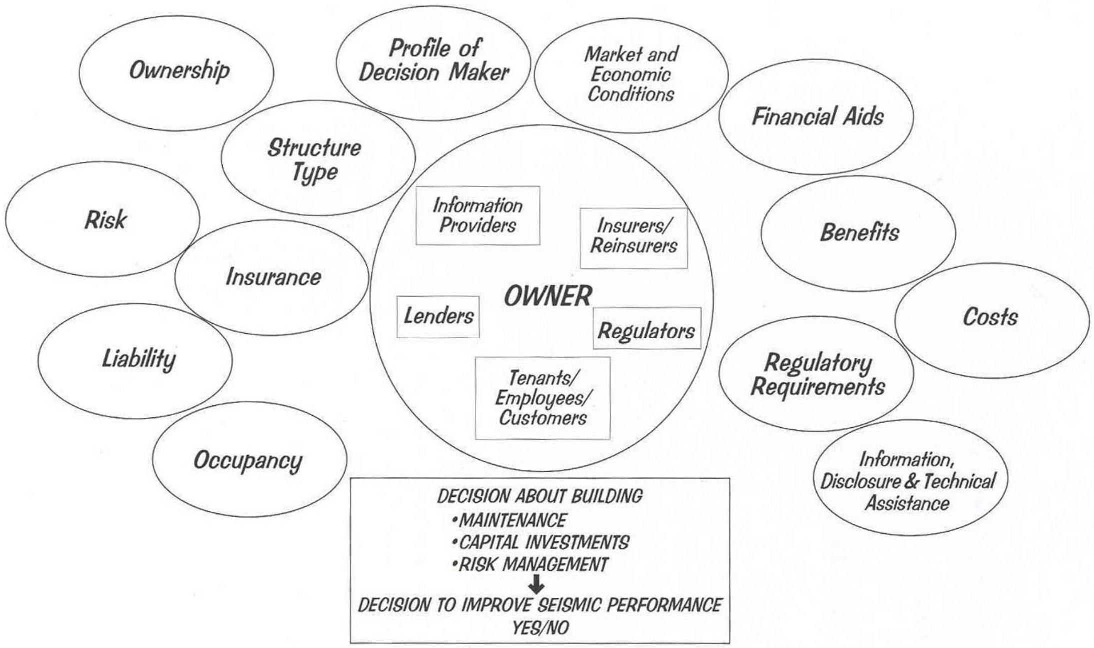

Figure 1 THE DECISION-MAKING CONTEXT: KEY CONSIDERATIONS

Emphasize Consequences, Rather Than Probabilities

As noted earlier, motivating action in response to low probability/high consequence hazards is inherently problematic. While some individuals and groups may overreact to such risks by focusing their attention exclusively on consequences and ignoring probabilities, a more common response is to "round down" low probabilities to zero. In other words, once probabilities are sufficiently low, there is a tendency to completely discount the hazard. At the extreme end of the continuum, there is little chance that programs will be developed to deal with a possible meteor collision with earth, simply because even though the consequences would be absolutely catastrophic, the likelihood is currently too low and the time frame far too long to motivate political action. The earthquake threat is certainly not in this category for states in the U. S. that have a significant earthquake risk, but the absence of recent severe earthquakes in many parts of the country does contribute to the sense that earthquakes are not a problem worth addressing outside areas of high seismic activity.

Seen in this light, while it is important to communicate information on what is known about the *likelihood* of seismic events of different magnitudes in areas on which advocacy efforts are focused—and to communicate those probabilities in effective ways—it is also necessary to give target audiences a clear idea of what the *consequences* of such events will be, should they occur. This need for focusing on consequences argues for a scenario-based approach to mobilizing support, rather than a more probabilistically-based one, particularly for communities that have not had recent earthquake experience and provided there is a good empirical basis for developing scenarios. Tied to specific localities and specific earthquake events, scenarios are a good tool for advocates because they help targets of advocacy visualize and personalize the consequences of those events.

The planning scenario that was developed by the Earthquake Engineering Research Institute for a 7.0 earthquake event on the Hayward Fault (Earthquake Engineering Research Institute, 1996) is a good example of a scientifically-based document that is also an excellent tool for educating the public and mobilizing support for seismic safety. The scenario shows in detail how a large earthquake on that fault would affect transportation systems, lifelines, and residential and other types of structures. It also provides a good case study on the ways in which visual materials, including maps and damage photos, can be used by advocates. Other scenarios already exist, and still others are in the process of being developed. Loss-estimation tools such as HAZUS make it possible for local communities to develop their own earthquake scenarios. Locally-focused scenarios are again more likely to be effective than more general statements about the likely consequences of future earthquakes, because they encourage recipients of the information to visualize and personalize those consequences in their own communities.

Carrying this idea one step further, advocates should always be on the lookout for generic information about earthquake consequences that can be "customized" for existing and potential supporters. For example, information on the impacts of past earthquakes, such as 1971 San Fernando, 1985 Mexico City, 1995 Kobe, or other events should can be repackaged for local audiences and decision-makers through the use of generalization and comparison. This is particularly important because many targets of influence may never have thought about the ways in which vulnerabilities are similar across different societies. Following the 1999 Taiwan earthquake, for example, National Public Radio featured interviews with practicing engineers and representatives of the Earthquake Engineering Research Institute who emphasized how the built environment in California resembles the built environment in Taipei and other large cities in Asia—messages that stressed, in other words, that "It can happen here." Discussions on the relevance of earthquakes in other societies to what could happen here must of course be scientifically credible (for discussions on how to enhance the credibility of risk information, see the chapter on risk communication in this volume). If used properly, such discussions can help potential supporters envision potential consequences that they might not have considered in the context of their own communities.

Think of Advocacy as a Form of Collective Action

As noted earlier, the formulation, adoption, and implementation of loss-reduction programs are examples of efforts to bring about social change. Advocates can better understand what they need to do to bring about change in the seismic safety arena by relying on insights derived from research on other change-oriented activities, such as studies of social movements. Broadly conceptualized, social movements are collections of individuals, organizations, and groups that operate with some degree of continuity and that are focused on bringing about (or in some cases resisting) social change. Examples of social movements that have had an impact in U. S. society include the movement for women's rights, the civil rights movement, and the environmental movement. Seismic safety can also be conceptualized in social movement terms—more specifically as a "professionalized" social movement (McCarthy and Zald, 1973). Advocates can thus draw upon lessons learned regarding factors that are associated with effective social movement mobilization.

Perhaps the most widely-accepted model in the field of social movements explains movement mobilization by taking into account three major factors (for discussions, see Tarrow, 1994; McAdam, McCarthy, and Zald, 1996):

- Political opportunity structures, consisting of both relatively stable and changing features of the political landscape that either help or hinder movements in achieving their objectives;
- Mobilizing structures, or the infrastructure through which people's efforts are channeled into movement activity—including informal groups, social networks, and more permanent organizations; and
- Framing processes, or efforts to define problems and solutions in ways that motivate collective action

For advocates of seismic safety, mobilizing support involves addressing these three building blocks of social movement organization and strategy. The sections that follow show the applicability of these concepts to collective efforts to promote seismic safety.

Take Advantage of Existing Political Opportunities and Create New Ones

Don Quixote is an admirable figure because of his idealism and his ability to "dream the impossible dream." However, Don Quixote was not a politician or a social movement activist. Like advocates in other issue areas, seismic safety advocates must recognize that politics is the art of the possible. Efforts to "think big" must be tempered by considerations of what is likely to be accomplished within particular risk contexts and policy environments, as well as what can be sold to the public and stakeholders on a cost-benefit basis. No advocate will ever succeed in getting all potentially hazardous buildings retrofitted, even in high-risk areas, Oakland will never be moved to a less hazardous location, and, other things being equal, some types of seismic loss-reduction policies are simply inherently more difficult to bring about than others.

In social movement terms, advocates must take into account the structure of political opportunities that exist at any given time—while continually trying to improve those opportunities. For any measure to be successfully adopted and implemented, there must be at least a minimal opening to allow for change, there must be some degree of political support for the measure, and opposition to the measure must not be overwhelming. With respect to certain seismic loss-reduction measures, such as large-scale retrofitting of existing hazardous buildings, political opportunities for change may simply be lacking in many areas of the U. S. to such a degree that those measures are essentially not feasible. At the same time, some degree of support for retrofitting hospitals or critical emergency facilities may be present. Effective advocacy involves continually testing the limits of what is feasible in different community contexts and formulating policies and programs that have at least a reasonable possibility of succeeding. To make these kinds of determinations, advocates must communicate on a continual basis with stakeholder groups—both supporters and opponents.

Various factors influence the structure of political opportunities for earthquake advocacy. Among the most important types of opportunities advocates can exploit are the following: the occurrence of earthquakes, including earthquakes taking place outside the jurisdiction in question; the appearance of new information that can serve to heighten concern about the threat, such as scientific forecasts or information concerning the vulnerability of certain types of structures; supra-local legislation or regulations that create new mandates or requirements; new opportunities to obtain funding for seismic loss-reduction programs; evidence that the programs that are being advocated are working well and producing benefits in other communities; and opportunities that may exist for forging or strengthening alliances with influential interest groups (e.g., groups representing the insurance industry) or for weakening the influence of seismic safety opponents.

Changes in the larger policy environment can restructure political opportunities and open policy windows. This can happen, for example, when new national legislation or statewide enabling statutes are adopted. As Berke and Beatley (1992) note, there are various things the federal government can do to facilitate the mobilization of support for local loss-reduction efforts and thus influence political opportunity structures. One approach is to encourage and support actions that focus attention on seismic issues. Another is to undertake actions that support non-governmental efforts to enhance seismic safety—for example, by facilitating the activities of code-writing bodies. A third is to use its own authority to mandate loss-reduction activities. States can also use similar strategies to promote seismic safety through supporting hazard mapping activities, passing laws, and forming state-level seismic safety agencies.

Currently, the Hazard Mitigation Act of 2000 is an example of federal legislation that is creating new opportunities for seismic advocacy efforts. Among other things, the Act establishes a pre-disaster mitigation fund for local communities, provides for the production of multi-hazard advisory maps that can be used by state and local governments, and increases the local share of hazard mitigation grant program funds from 15% to 20% for states that undertake "enhanced" disaster planning activities.

Disaster loss-reduction advocates must be poised to seize upon windows of opportunity that open following disaster events—for example, by working in advance to develop the policies and programs they want to see adopted and then waiting for the opportunity the disaster presents. As Birkland (1997) observes, disasters have the potential for becoming "focusing events" that can increase mobilizing opportunities and alter policy agendas. Disasters automatically generate media coverage, and they can be "particularly important to individuals of groups that are part of relatively weak advocacy coalitions" (Birkland, 1997: 33). Disasters raise public awareness while creating dramatic evidence that the problems identified by advocates are indeed real and that policies currently in place are inadequate.

It should also be noted, however, that focusing events do not automatically lead to positive policy responses. Birkland (1997) emphasizes that advocacy coalitions must already be organized and ready to take advantage of the political opportunities created by such events.[11] As

[11] In this respect, Birkland contrasts earthquake and hurricane policy domains. In the earthquake area, sufficiently strong constituencies exist that make it possible to take advantage of opportunities presented by focusing events.

discussed above, when a disaster occurs, advocates must already have well-devised solutions that they can promote. And even when a focusing event provides some impetus for change, advocates must still have strategies for surmounting barriers that will emerge throughout the policy process. Equally important, the solutions proposed in the aftermath of focusing events must be both sound and implementable. Put another way, little is gained if a disaster event results in the adoption and implementation of measures that fail to address real problems or that have negative unintended consequences.

Advocates should also recognize that they do not have to wait for focusing events to occur. Instead, they can create them—or at least target specific focal points for mobilization. In the late 1990's, the nation mobilized in a massive way to ameliorate potential problems associated with the Year 2000 computer problem. Indeed, the organized effort to deal with the Y2K problem was arguably one of the country's largest and most successful mitigation campaigns. There were many reasons why government and the private sector devoted so much effort to countering the millennium bug. One reason was that advocates for Y2K remediation succeeded in getting the problem defined as a major economic threat requiring strong governmental action. However, another obvious reason was that December 31, 1999 was a "date certain"—a deadline or focusing event that was clear to all stakeholders and that could not be postponed. Hazard-reduction advocates seldom have such clear-cut deadlines, but they can try to create them. This is the strategy that is currently being undertaken in the San Francisco Bay Area, where advocates are promoting the "Quake '06" initiative, which capitalizes on the 100th anniversary of the 1906 earthquake, in order to mobilize public and stakeholder support. Efforts are also under way to use the same approach in connection with the 10th anniversary of the Northridge earthquake in Southern California.

Advocates can also attempt to pry open windows of opportunity by creating and building on small successes and by publicizing the successes of others. Advocates may find it difficult to mobilize and sustain support for loss-reduction measures in the absence of initial positive results, especially when other inducements are lacking. It is thus important for advocates to think not only in terms of bringing about longer-term loss-reduction goals, but also of intermediate objectives that can be achieved relatively quickly and easily. For example, the Disaster Research Center's study on Project Impact program implementation found that loss-reduction initiatives benefit considerably from early and tangible successes, both because successes demonstrate that improvements are possible and because they help sustain supporter commitment. Project Impact program participants saw initial successes, even modest ones, as providing important incentives for continued partner involvement with the program. Where evidence of initial progress was not forthcoming, partner activity and commitment to the initiative tended to decline.

When successes do take place, it is important to provide as much publicity as possible for those successes—and for the advocates that were responsible for them. After the 1994 earthquake, for example, numerous stories were written and presentations made on the successful seismic retrofit of the Anheuser-Busch brewing and distribution facility located near the earthquake's epicenter.

Comparable advocacy groups do not exist in the hurricane area, which is one reason why there has been less concerted action to respond to hurricane hazards.

This widely-promoted success story demonstrated the efficacy of seismic retrofitting for industrial facilities, and it also brought a great deal of positive publicity both to Anheuser-Busch and to EQE, the engineering firm that was responsible for the retrofits. Also following the Northridge earthquake, systematic research was conducted that indicated that various types of seismic safety measures that the state and local communities had adopted had indeed had the desired effect—that is, they had reduced subsequent losses in the 1994 quake (Olshansky, 2001). Other success stories include the adoption of the New York City seismic code, California's Seismic Hazard Mapping Act, and the enactment of seismic legislation in Oregon, Arkansas, and other states.

As in cases like these, where measures have been shown to be effective, they should be showcased by advocates. This was the logic behind FEMA's effort to publicize "mitigation success stories"—the notion that advocates need examples they can use to show that particular programmatic efforts can be successful in reducing losses. Through the Project Impact program, FEMA also sponsored national and regional Project Impact summits that enabled participating communities to share both success stories and advice about how to bring about successful loss-reduction efforts.

In this same vein, testimonials from individuals who have had experience with the enactment and implementation of loss reduction measures can also have an important impact on mobilization efforts. Testimonials are particularly effective when made by individuals who have a great deal in common with target and stakeholder groups—e.g., when building officials who have experience with seismic retrofit programs speak to other building officials, or when those who have developed and implemented seismic safety elements for local general plans talk about that process with other planners. As discussed in the chapter on risk communication in this report, audiences are generally much more willing to listen to advice from spokespersons who resemble themselves—as opposed to perceived outsiders.

Continuing with the theme of exploiting successes, other things being equal, it is easier for advocates to mobilize support for measures and strategies that are already being implemented elsewhere than to invent new ones. Codes are one such example. Building codes, seismic codes, and recommended seismic provisions already exist. The role of the advocate is to take advantage the existence of codes and to ensure that they are adopted and implemented. The FEMA 313 guidebook, "Promoting the Adoption and Enforcement of Seismic Building Codes," provides step-by-step guidance for advocates on how states and localities can adopt existing building and seismic codes, as well as on how they can encourage code enforcement. Similarly, loss estimation techniques are already being used in seismic policy and program development, which means that advocates can work with HAZUS users' groups and make contacts with counterparts in other communities to find out how they have been employing HAZUS to influence seismic decision making, and then adopt those same strategies.

Utilize Existing Organizational Networks and Create Networks Where They Don't Already Exist.

Studies on social movements and collective action indicate that one factor in movement success is the ability to utilize existing organizational networks and sustain viable networks over time. In addition to providing resources and communication channels, such networks help resolve fundamental problems of collective action, such as the free rider problem. Rather than being based on the activities and commitment of individual advocates working on an ad hoc basis, successful seismic safety programs, like successful social movements, must be able to rely on an ongoing organizational infrastructure.

The development of networks and partnerships has been a key ingredient in many hazard-reduction initiatives. Among the objectives of the Southern California Earthquake Preparedness Project and the Bay Area Regional Earthquake Preparedness Project, both of which were established in the early 1980's through federal-state collaboration, were to establish local seismic safety partnerships, build organizational networks, educate the public about the earthquake hazard, and play an advocacy role in local seismic safety politics. In many ways, these organizations constituted prototypes for other programs that were subsequently formed to build partnerships and engage in advocacy, including the Central U. S. earthquake consortium and other regional consortia. FEMA's Project Impact, which was established in the late 1990's, also resembled SCEPP and BAREPP, particularly with respect to its community-based focus and emphasis on partnerships and local capacity-building.

Ideally, advocates should have close relationships with groups that they can consult for advice and readily mobilize when there is a need for action on a particular issue. Pre-existing organizational networks that can be utilized by advocates include both those that are already active in seismic safety policy arenas and those that could potentially be mobilized to greater levels of activity. For example, the California Seismic Safety Commission, the Cascadia Regional Earthquake Working Group, the Western States Seismic Policy Council, the Earthquake Engineering Research Institute, and local EERI chapters are already self-designated advocacy organizations. Structural engineers' associations, which are well-organized in Northern and Southern California and in other parts of the U. S., also constitute networks that can be mobilized to support earthquake safety measures. Local neighborhood watch organizations, some of which are currently actively involved in earthquake safety, constitute yet another set of largely untapped networks that can be a potential source of support for seismic safety advocates.

In areas where earthquake-oriented groups do not yet exist, advocates must work to develop such networks and to persuade other existing groups to support earthquake-related initiatives. Targets for mobilization could include victim advocacy groups formed in the aftermath of other disasters, environmental groups, and coalitions focused on neighborhood improvement and quality-of-life issues. Other outreach targets include community colleges, colleges, and universities, especially their GIS laboratories and departments of urban planning, civil engineering, and geology. FEMA's "disaster-resistant universities" initiative and its efforts to engage the research community in hazard-reduction efforts constitute important models that advocates should attempt to emulate in their own communities.

Develop Mobilization Strategies Based on the Concepts of Framing and Frame Alignment.

To engage audiences and mobilize public support, issues of seismic safety must be appropriately framed—that is, they must be conceptualized and defined in ways that enable people to understand the earthquake issue and appreciate its importance. Framing is essential at all stages of the policy process; regardless of the policy in question. Problems and solutions must be framed in ways that make them easily understood and likely to be supported by both existing and latent constituencies, as well as in ways that help neutralize opposition.

Policy successes are linked in important ways to framing successes. This can be seen clearly in current and recent struggles in other policy domains, such as those associated with smoking. The anti-smoking movement has been so successful in part because it has been able to frame smoking both as a major health problem requiring governmental intervention (as opposed to being simply a behavior involving individual choice) and as an issue involving the rights of non-smokers, particularly the right not to be exposed to second-hand smoke.

A 1980 report on the earthquake threat that was released by the Federal Emergency Management Agency gives insights into the importance of framing (Federal Emergency Management, 1980). That report included death and injury estimates for Southern California earthquakes, which helped convey a sense of the potential severity of a major Southern California event. However, it also focused in particular on defense-related and other high-technology industries that were at risk in the event of a major Southern California earthquake. Using those data, the report framed the earthquake problem in national security terms. For perhaps the first time, vulnerability to earthquakes was linked in the mind of policymakers and interested constituencies with the defense capabilities of the entire nation. In addition to showing the national importance of a regional threat, the "national security" frame was one that was difficult to oppose directly. Earlier, the Field Act had been passed in California because seismic safety in public schools was successfully framed as a child-protection issue. After the 1933 Long Beach earthquake, taking the position that it would be acceptable to have schools collapse and bury children was simply untenable.

Currently, the earthquake threat has great potential for being framed in terms of the economic risks it potentially presents in our society. Advocates can reasonably argue that the U. S. economy is currently so precarious, particularly in the wake of the stock market meltdown and the terrorist threat, that it is completely incapable of sustaining any additional shocks. Framed in this manner, enhanced seismic safety can be presented as a bulwark against future economic ruin. A catastrophic or near-catastrophic event can also be presented as potentially creating a major crisis in the availability of insurance—much like the terrorist threat has done. On a more local level, examples such as the declining fortunes of Port of Kobe after the 1995 earthquake can be used to show how experiencing an earthquake can lead to economic disruption and loss of a competitive edge for particular industries or regions. Such efforts seek to frame the earthquake threat in broader terms, as a threat to economic sustainability.

Research on social movements, framing, and the mobilization of support is especially relevant to discussions of seismic safety advocacy (see, for example, Snow, et al., 1986; Snow and Benford, 1988). The research literature sees the mobilization of public support for social movement objectives as involving various "frame alignment" processes. The concept of frame alignment refers to strategies that social movement advocates adopt in order to align or "map" movement objectives or frames onto those that potential supporters already share. In other words, rather than seeking directly to convert potential supporters to a movement's cause, advocates concentrate on "packaging" movement objectives in ways that show them to be consistent with those of individuals and groups they are seeking to mobilize. In the case of the seismic safety movement, this would involve framing the earthquake threat in ways that connect it to issues with which influential and active constituencies are already concerned. Such issues could include historic preservation, affordable housing, neighborhood safety, and the protection of children. In essence, rather than persuading people to care more about the earthquake threat, seismic safety advocates would instead focus on showing how earthquake vulnerability is related to issues they already care about.

A slightly different frame alignment strategy would focus on more closely linking seismic safety issues to other *risk-related* issues with which potential supporters are already concerned. On the preparedness side, preparing for earthquakes can be framed as contributing to protecting neighborhoods and households against other risks, such as crime, terrorism, and bioterrorism. Similarly, earthquake hazard mitigation can be presented in terms that show its positive contribution to providing protection from other threats—for example, through showing building owners how structural and nonstructural mitigation measures also provide protection against blast hazards.

Frame alignment efforts should focus on the ways in which the adoption of seismic safety measures is linked to objectives being championed by other organized constituencies that are active in local policy-making—for example, open space where development is restricted or historic downtowns that will attract tourists for generations because they have been protected through seismic retrofitting. Advocates can refer to studies like the one conducted by Christopher Arnold in Santa Cruz several years after the Loma Prieta earthquake, which shows that a reconstruction process guided by concerns about future seismic safety and the redevelopment of a more disaster-resistant downtown provided many other positive outcomes for the community (Arnold, 1998). In more general terms, adopting and implementing seismic safety measures can be coupled with frames that center on issues of sustainability, broader environmental concerns, and quality of life, all of which are values that mobilize large and active constituencies. Similarly, appeals can be made to potential private sector supporters based on their own concerns regarding business continuity and competitiveness following disasters.

In sum, advocates should pay careful attention to framing issues, both at the policy formulation stage and throughout the policy process. Mobilizing public support depends in very important ways on the manner in which earthquake-related issues are framed for different target audiences. Opportunities exist for linking the earthquake threat to other concerns that are more central to well-organized and influential constituencies, and advocates should seize those opportunities. There is no reason why earthquakes cannot be framed in much broader terms than they currently are—for example, as threats to community viability and economic survival. Earthquake safety can be tied to concerns around which community activist groups routinely mobilize (such as livability, open space, and historic preservation) and linked more closely to emerging threats, such as homeland security. Indeed, advocates should recognize that effective advocacy always depends on the effective framing of political issues and on linking "specialized" problems such as natural hazards to more general ones that are already on the public agenda.

Other Advice for Advocates: Devise Ways of Providing Incentives for Supporters, Advocates, and Those Affected by Loss-Reduction Policies

The research literature also emphasizes the importance of incentives for stakeholders in the policy process, including supporters of proposed programs, those who will be affected by new seismic safety measures, and advocates themselves. The initial challenge is to understand what kinds of rewards stakeholders value. For supporters, media publicity may be one such reward. Focusing again on Project Impact, program participants have indicated that many Project Impact partners—that is, organizations and groups that agreed to support and promote local disaster loss-reduction efforts—value the media coverage that they received as a result of their Project Impact involvement.

For some groups, supporting loss-reduction brings direct economic rewards. For example, private-sector business partners involved with Project Impact, such as hardware stores selling supplies needed for home mitigation projects, benefited from free advertising and an expanded market for their products. Structural engineers, architects, and other design professionals clearly represent a constituency for whom participation in and support of seismic advocacy efforts makes good business sense—which is one reason why members of these groups are often leading promoters of earthquake safety. Insurance industry coalitions have become major advocates for hazard loss reduction in part because it is in their economic interest to do so.

Incentives are key to encouraging compliance with and reducing opposition to loss-reduction programs. The Earthquake Engineering Research Institute's report on impediments and incentives to enhanced building seismic safety (1998) points to a wide variety of financial and other incentives available to public- and private-sector entities that can heighten participation in and weaken opposition to seismic safety. Those incentives include loans, insurance, technical assistance, subsidies for study designs and engineering analyses, relief from regulation, such as the relaxation of parking requirements, point-of-sale hazard disclosures, and measures that seek to increase liability for seismic hazards. That same report provides a number of examples of how communities have acted in creative ways to provide incentives for seismic upgrading. For example, one community permitted increased occupant density and allowed additions to be made to strengthened buildings without requiring additional parking in order to encourage compliance. Other communities paid for engineering studies and plan development and established grant and deferred loan programs.

Incentives are important in other ways. Champions and earthquake entrepreneurs are essential to the policy process, because they help guide earthquake safety measures through the policy process, but champions themselves need to be rewarded for their efforts. Developing ways of publicly recognizing seismic safety activism is thus one important strategy for sustaining change-oriented activity over the long term. The Alfred Alquist Award, which was established to recognize outstanding contributions to seismic safety, is an example of one way to reward dedicated advocacy. Media recognition and professional prizes are others. FEMA's Project Impact used the strategy of publicly acknowledging successful community loss-reduction efforts—and the advocates associated with those efforts—at annual Project Impact summits as a way of sustaining those activities and encouraging other communities to emulate their more successful counterparts.

Concluding Comments

This paper has suggested that seismic safety advocacy efforts can be viewed as parallel in many ways to social movement activity—except for the fact that advocacy efforts typically proceed from within the policy system, rather than from outside it. Like any effort at mobilizing collective action, seismic advocacy cannot move forward without a political environment that is at least somewhat conducive to success, an organizational infrastructure that is capable of sustaining collective action over time, and conceptual frames that generate support and weaken opposition to proposed measures. To have an impact, advocates must address these three elements in the mobilization process simultaneously.

The paper has also called attention to the need for an approach to the policy process that is both holistic and contextual. Rather than engaging in advocacy in a step-by-step, linear fashion, advocates must be able to chart a long-term course that takes into account political, economic, and other constraints that exist in the policy environment. Thinking contextually about the policy process involves understanding stakeholders' decision contexts, as well as understanding the broader political and economic contexts in which seismic policymaking is carried out.

The importance of incentives is another theme that has been emphasized in the foregoing discussions. Incentives are important at all stages of collective action and for all participants in the policy process. Groups will not support loss-reduction efforts unless they stand to gain tangible benefits from doing so. Stakeholders who will be required to change their behavior as a result of policy adoption also need incentives. Equally important, advocates themselves must gain rewards and recognition for the work they do.

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